Current Science

Vol. XVIII] JUNE 1949 [No. 6

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THE EGERTON COMMITTEE REPORT

THE long and the eagerly awaited press summary of the report of the Egerton Committee on the working of the Indian Institute of Science, has appeared in the Daily Press and according to the same source, the full report is scheduled to come up for discussion before the Governing Council of the Institute at its meeting to be held during the first week of July. The Egerton Committee is the fourth of its kind which has periodically reviewed the work of the Institute and made recommendations on its future development. According to reports appearing in the press, the report consists of 68 pages of printed matter and is divided into four sections: (1) General considerations and character of the Institute, (2) Organisation and Administration, (3) Review of the work of the Institute and (4) Financial review.

The Committee considers that the character of the Institute has changed considerably during its life of some forty years and concluded that the Institute has, as it exists to-day, much in common with sister establishments like the Imperial College of Science, London, and the Massachusetts Institute of Technology, Boston. The Committee is of the opinion that having regard to the broad intentions of the illustrious Founder and the prospective needs of the country during the next 20 years, the Institute should develop along the lines of a higher technological institute, its functions being mainly post-graduate teaching and research. The Committee has gathered the impression that the development of the Institute has not been entirely satisfactory and that it has not attained the status it might have done. The

lack of a clear, well defined and uniformly sustained directive has been considered to be responsible for the vascillating, timid and hesitant character of the policy which has distinguished the administration of the Institute in the past. It will be recalled that the preceding Reviewing Committees also have made in their reports a similar remark. In 1921 the Pope Committee recorded "it cannot be denied that the Institute has lost in efficiency by reason of the fact that its policy and lines of development have never been defined with sufficient precision". The Sewell Committee in 1930 also deplored the lack of a definite policy and expressed the opinion that "a suitable balance of pure and applied research had not been established and that greater emphasis should be laid on fostering contacts between the Institute and the industries in India". The Irwin Committee which had the misfortune of conducting the enquiry in the then prevailing tempestuous atmosphere of prejudice and passion, "felt compelled to consider the whole question of the aims and objects of the Institute" and expressed the view that the "province and purpose of the Institute must be defined in more precise terms than at present" and pleaded that "such a definition should be adopted officially both by the Council of the Institute and by the Government of India". It is regrettable that the Egerton Committee, the fourth in succession, should still have been obliged to record the lack of a well-defined objective in the development of the Institute.

The Egerton Committee has taken note of the fact that the Institute has greatly expanded in recent years, both in scope and size, and that several new departments of national importance have been inaugurated. These far-reaching developments are due to the vision and statesmanship of Sir J. C. Ghosh who, in the best interests of the smooth, effiicent and ordered execution of these expansion plans, should never have been disturbed from his position as Director. Before further stages of expansion are initiated, it is felt, that the present expansion should be satisfactorily completed and fully consolidated. The expansion schemes should take into consideration the lines of development of the National and other laboratories and avoid wasteful duplication of scientific effort. It is generally felt that the administration of the Institute has not bestowed adequate thought to this aspect in its scheme of expansion; it is not difficult to point out duplications in the lines of development. In this connection it is pertinent to quote the Sewell Committee which has declared that "whatever developments take place in the universities, we are convinced that with the resources at its disposal, this Institute ought always to be in a position to supply such opportunities for training as cannot be obtained anywhere else in India. *This Institute should do what no other institution can do. It should maintain a position of pre-eminence; it should acquire a national, even a world reputation; it should become a place of reference*".

The Committee have generously admitted that the Institute has an established position and has, in the past, constituted a centre of research where much has been accomplished and valuable personnel trained. The happy circumstance that some of the most responsible positions in the scientific departments and industrial concerns are held by the alumni of the Institute bears eloquent testimony to this proud fact. The late Sir Martin Forster who was during his directorship associated with a brilliant team of departmental heads—Drs. Simonsen, Norris and Catterson-Smith, has been largely responsible for this solid contribution.

A criticism which may be legitimately offered in connection with the development of the Institute relates to the question as to why the Institute has not established itself as an international centre of research. Forty years is a sufficiently long

period for an institute to achieve this distinction. To-day some may even challenge the pre-eminent position which the Institute is expected to occupy in the scientific and technological life of the country. The Egerton Committee provide an answer to this when they state that the status and development of an institute "like that of all organisations will depend largely upon the calibre of the men in the higher posts". The Committee have attached the greatest importance to the question of choosing proper *Men*, the most vital of the four Ms enunciated by Professor A. V. Hill.

Sir C. V. Raman, soon after he assumed charge of the Directorship of the Institute in 1932, found the Institute wanting in the right type of men and made a vigorous attempt to staff the Institute with men of international eminence. His world-wide fame and his universally recognised eminence and prestige constituted great assets in attracting the topmost men of science to occupy some of the positions which fell vacant during his distinguished directorship. Professor George Hevesy, for example, who later received the Nobel Prize, was to have occupied the Chair of Physical and Inorganic Chemistry if events had moved in a direction fortunate to the Institute. Unfortunately for the Institute, a great opportunity was lost; the prospect of a glorious future envisaged at that time was, shall we say, postponed for another two decades. It is interesting to reflect that Sir C. V. Raman, some 17 years ago, had already anticipated the recommendations of the Egerton Committee, particularly with respect to the expansions, *e.g.*, the Chair of Mathematical Physics and the Department of Instrumentation.

The Egerton Committee appear to have emphasised the imperative need of a scientific man of eminence "with a keen appreciation of research and a capacity for leading men", for presiding over the affairs of the Institute as the Director; they add that the Director should be invested with full powers for administration. The Pope Committee considered that the Principal (Director) "should be a scientific man of eminence and of proved administrative capacity; no person, however capable he may be, can preside with intelligence and sympathy over the operations of the Indian Institute of Science if he is not himself steeped in scientific modes of thought and scientific aspirations". It may be useful to record here the views of President Vannevar Bush of the Carnegie Institution of Washington who has declared: "The Directors of Departments and Chairmen of Divisions in the Institution occupy posts demanding a rare combination of abilities. The position of the director is marked even more strongly by that duality which I have noted in the functioning of the Trustees. The director can and should be both an investigator and an administrator. As an investigator he joins with his colleagues on a plane of equality in planning a scientific program in which all participate and in which he has his unique part. As the director he administers the program, resolves differences of view, and maintains contact with the President and Trustees. To meet this dual responsibility, he must be a scientific worker of proved ability, and he must possess the qualities of leadership, inspiration, and firmness that evoke the best efforts of colleagues and keep operations moving in the agreed direction. He must likewise have the ability at understanding and guidance for which younger members of the staff will look to him. Thus as an investigator he shares the duty of all scientific men toward rigor, vision, and collaboration. As an administrator, he faces the same duties and needs the same capabilities as does the head of a department in an academic institution and, to some extent, as does the director of research in an independent laboratory."

If men of eminence cannot be found in

India, we should not hesitate to invite others irrespective of nationality. The Sewell Committee records that "in more cases than one, the reputation of a university has been built up round the work of some pre-eminent men. Students are attracted by the reputation of the man under whom they hope to work, rather than by any particular virtue of the university itself. A Nernst or a Ramsay (or a Raman) would draw men to any Institution to which he happened to be attached. We are of the opinion that the Chairs in the Institute should be filled by men of the highest eminence irrespective of nationality and we recommend therefore that the terms of appointment to the Directorate and Professoriate be made sufficiently favourable to attract such men." The Egerton Committee holds the same view and has accordingly recommended "a revision of salary scales so as to attract and retain men of the highest level".

We hope and trust that the Governing Council of the Institute will take early action on these recommendations and maintain the exclusive and pre-eminent character of the Institute, a position to which it is entitled not only because of its pioneering and brilliant services in the past but also because of the potential prospect of an even greater and glorious future which belongs to it.

THE ADVENTURE OF EDUCATION*

THIS admirably printed and edited Journal is published under the auspices of the Office of the Educational Adviser to the Government of Bombay. Annual Subscription payable in advance is Rs. 8 only; and single copy Rs. 1-8-0 only.

To quote from the Editorial, the ambition of the Editorial Board is "to make the Magazine reflect truthfully (and if possible in a refreshing manner) the trends of educational thought and practice both inside and outside the Province, and we, therefore, invite all those who have anything significant and sincere to say about education, to make use of the Journal". Thus at a time when the country is feeling the effects of newly earned freedom and is planning for an all round development, a journal of this kind devoted to the cause of education and the spread of educational thought is, indeed, quite welcome.

The Journal aims not only at presenting outstanding educational problems in a clear way but also at giving special attention to new educational developments both in India and abroad in the hope that their study will stimulate freshness of approach on the part of teachers. The object is to provoke educational thought and lead to adventurous activity.

In addition to the Editorial, the Journal has the following features:— Educational problems, Education forges ahead, the Educational Digest, the Educational World, the World of Books and the Teachers' Forum. There are a number of interesting articles in this issue of the Journal and a note on "Our Contributors". We wish the Journal useful service and a bright career.

* "The Adventure of Education," Vol. I, No. 1, Jan. 1949, pages 124, a bi-monthly by Mr. K. G. Saidain with an influential Editorial Board.

AN INVESTIGATION INTO THE HEAT-TREATMENT OF SILICO-MANGANESE SPRING STEELS

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A GENERAL impression prevails in the metallurgical field that low carbon silico-manganese spring steels are abnormally sensitive to heat-treatment and are difficult to harden completely. There is a considerable difference of opinion as to the correct treatment of low carbon silico-manganese steel. Colbeck and Hanson[1] have established that temperatures required for complete hardening of these steels are very much higher than the corresponding hardening temperatures for plain carbon steels with the same carbon contents. In one steel containing carbon 0·39%, silicon 1·98%, sulphur 0·027%, phosphorus 0·041% and manganese 0·885%, they put forward a temperature of 1110°C. for complete hardening. In another case with carbon 0·50%, silicon 1·5%, sulphur 0·039%, phosphorus 0·039% and manganese 0·865%—a temperature of 900°C. was claimed to secure complete hardening. Andrew[2] pointed out the theoretical aspects of the problem inasmuch as the high silicon contents of the steels gradually lifted up the A_1 critical points and lowered the A_3 critical points until in a 2% silicon iron, the A_3 point was completely absent. These have also been the observations of Baker[3] and of Hadfield and Osmond[4].

With, of course, increasing amounts of carbon in the silicon steels, the percentage of silicon required to cause the disappearance of A_3 point or in brief to close the $\alpha+\gamma$ loop would be higher. In practice with low carbon silicon steels, A_1 point gets uplifted so that higher heat-treating temperatures would be needed to form homogeneous Austenite which would on quenching yield the requisite hardened martensitic structures.

Andrew and Richardson[5] have shown that silico-manganese spring steels require a higher temperature in comparison to chrome-vanadium or plain carbon spring steels for hardening and further that the former are the most susceptible to decarbusisation during heat-treatment and to mass effect. Burns[6] also observed that silico-manganese steels require a high hardening temperature to develop their best mechanical properties. Charpy & Cornu[7,8] and Vigoroux[9] also observed the elimination of A_1 and A_3 critical points in silicon steels. Guillet[10] has recommended a hardening temperature of 850°C. for steels containing 0·35 — 0·45% carbon, 2% silicon and about 1% manganese.

EXPERIMENTAL PROCEDURE

The object of the present investigation undertaken by the author was to further explore the hardening characteristics of various compositions of Indian silico-manganese spring steels. The steels were rolled into flat bars of different sections and cambered into a spring leaf as used in railway locomotives, carriages and wagons. These flat bars were then subjected to different heat-treatments. Individual heat-treated spring leaf was then subjected to a "Scragging" test. This consisted of putting the cambered, heat-treated spring leaf bar under a powerful steam hammer. At dead centre of the standard length of the bars camber AB (Fig. 1) was measured. The hammer was then made to press the cambered

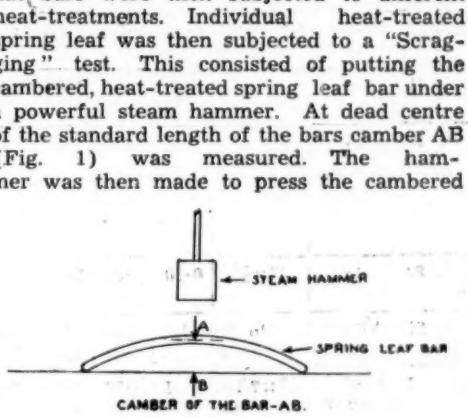

FIG 1.

spring bar totally flat. It was then released. The camber AB was again measured. If the permanent set after the first blow exceeded 5/16", the bar was considered to have failed in the test. Again the hammer pressed the spring bar flat six times in succession. The camber AB (Fig. 1) was again finally measured. The bar should not show any more permanent set beyond what it had obtained after the first hammer blow if it were to pass the "Scragging" test.

TABLE

Results of Tests on Silico-

Batch and Sample No.	Type Carbon (C) and Silicon (Si)	Section All bars were of the same fixed length (Width × thickness)	Chemical Analysis			Heat Treatment				Scragging Tests		
			C %	Mn %	Si %	Quenched in	Quenched from (temperature)	Soaked for	Tempered at (temperature)	Initial reading	After first blow	Set after first blow
Batch A 2	Medium C ,, Si	4½" × 7/16"	0·55	1·00	1·88	Oil	950° C.	30 Min.	350° C.	3·5/16"	2·15/16"	3/8"
,, ,, 6	do	do	do	do	do	Water	do	do	do	do	3·3/16"	1/8"
,, ,, 10	do	do	do	do	do	do	900° C.	do	do	do	3·3/4"	1/16"
,, ,, 9	do	do	do	do	do	do	850° C.	do	do	3·13/16"	3·11/16"	1/8"
,, ,, 3	do	4" × 6/16"	0·54	0·96	1·95	Oil	950° C.	do	do	3·7/8"	3·5/16"	9/16"
,, ,, 7	do	do	do	do	do	Water	do	do	do	3·9/16"	3·7/16	1/8"
,, ,, 8	do	do	do	do	do	do	920° C.	do	do	4·1/8"	4"	1/8"
Batch B 12	Low C High Si	3·1/8" × ½"	0·47	0·91	1·83	Oil	900° C.	do	do	3"	2·13/16"	3/16"
,, ,, 11	do	do	0·46	do	1·80	Water	850° C.	do	do	3·1/16"	2·15/16"	1/8"
,, ,, 13	do	do	do	do	do	Oil	do	do	325° C.	3·1/4	3·0"	1/4"
,, ,, 20	do	4" × ½"	0·50	0·98	2·10	Oil	do	do	350° C.	2·13/16	2·3/4"	1/16"
,, ,, 21	do	do	do	do	do	Water	do	do	do	2·15/16"	2·15/16"	Nil
Batch C 1	Low C Low Si	4" × 7/16"	0·51	0·93	1·76	Oil	950° C.	30 Min.	350° C.	3·5/8"	2·7/8"	3/4"
,, ,, 5	do	do	do	do	do	do	975° C.	do	do	3·11/16"	3·1/8"	9/16"
,, ,, 4	do	do	do	do	do	Water	950° C.	do	do	3·9/16"	3·3/8"	3/16"
Batch D 16	High C Low Si	4" × ½"	0·64	0·90	1·89	do	850° C.	do	do	2·15/16"	2·29/32"	1/32"
,, ,, 17	do	do	do	do	do	do	900° C.	do	do	do	2·15/16"	Nil
,, ,, 18	do	do	do	do	do	Oil	do	do	do	3"	2·13/16"	3/16"
,, ,, 19	do	do	do	do	do	do	850° C.	do	do	2·13/16	2·5/8"	3/16"

I

Manganese Spring Steel Flats

(Reading) AB (Fig. 1)			Hardness Test			Microscopic Examination (Microstructures)
			Surface	Section		
After sixth blow	Set after sixth blow	Perfor mance in scrag-ging test	B.H.N. Centre	B.H.N. Ends	V.P.H.N On Cross Section	
2·15/16"	Nil	Failed	461	477, 477	564, 570, 550	Tempered Martensite with little feathery ferrite at grain boundaries. Grain size fine to medium. Troostite at boundaries
3·3/16"	Nil	OK. Stood	524	534, 555	635, 618	Uniform tempered martensite with complete absence of free (fethery) ferrite indicating proper quenching
3·1/4"	Nil	do	601	578	644, 626	do
3·11/16"	Nil	do	585	534	640, 618	do
3·5/16"	Nil	Failed	444	444, 429	564, 564	Tempered martensite with free ferrite at grain boundaries. Martensite more tempered than other samples
3·7/16"	Nil	OK. Stood	555	555, 551	593, 618	Uniform tempered martensite with complete absence of free ferrite indicating proper quenching
4"	Nil	do	606	578, 601	635, 626	do
2·13/16"	Nil	do	495	514, 415	543, 511	Tempered martensite with ferrite at grain boundaries
2·15/16"	Nil	do	534	534, 477	601, 593, 582	Uniform fine grained tempered mortensite with complete absence of free ferrite at grain boundaries
3"	Nil	Just Passed if tempered at 350°.Cit would have failed	477	444, 444	571, 593, 505	Tempered martensite with some free ferrite at grain boundaries
2·3/4"	Nil	OK. Stood	503	495, 471	580, 586	Fine grained tempered martensite with no free ferrite at grain boundaries
2·15/16"	Nil	do	555	555, 538	601, 630	Tempered martensite completely free from any free ferrite seperation
2·13/16"	1/16"	Failed	372	363, 365	459, 449	Fine grained tempered martensite with feathery free ferrite at grain boundaries indicating separation during oil quenching
3·1/16"	do	do	444	415, 426	536, 511	Tempered mortensite structure with lots of grain boundary ferrite in feathery from indicating separation during oil quenching
3·3/8"	Nil	OK. Stood	514	522, 514	609, 618, 601	Tempered martensite structure with extremely small amount of feathery ferrite at grain boundaries indicating drastic quench
2·29/32"	Nil	do	526	530, 564	606, 593	Tempered martensite structure with no free ferrite
2·15/16"	Nil	do	564	530, 538	571, 571	do
2·13/16"	Nil	do	514	461, 440	550, 557	Fine grained tempered martensite with very small amounts of feathery free ferrite at the grain boundaries
2·5/8"	Nil	do	514	520, 550	557, 571	do

Different sections of each bar were then subjected to a thorough microscopic examination and its micro-structure studied. As would be observed from the details of microscopic examination in Table I those bars which had passed the "Scragging" test exhibited tempered martensitic structures with practically no or a little feathery free Ferrite which had separated during quencning for hardening. Failed bars showed feathery Ferrite formation at the grain-boundaries.

Brinell and Vickers Pyramid Hardness measurements were taken at the ends and centres of the bars on the surface as well as on the cross sections of the bars.

Some typical results obtained during the above tests are recorded in Table I.

From the results of the above experiments it would be observed that fast quenching rates applicable in water-quenching even from 850° invariably gave satisfactory "Scragging" test results whilst oil quenching failed to give satisfactory response in the "Scragging" test in some cases from temperatures as high as 975°C. Water-quenching cannot, however, be recommended for commercial practice owing to the dangers it involves of distortion, warpage, cracking, etc., in particular for high carbon compositions. For low carbon compositions upto 0·40% carbon water-quenching may be safely employed. The above tests were conducted under ideal laboratory conditions of oil bath, regulated heating, one bar singly heat-treated at a time, etc. In commercial practice, the spring bars have to be heat-treated in batches and not singly. Thus although oil-quench from 850°C. have yielded in some cases satisfactory results in the "Scragging" test, in commercial practice higher hardenning temperatures of 900°C. or above would be most essential for satisfactory hardening and "Scragging" test performance.

Before, however, finalizing the commercial heat-treating procedure, it would be best to conduct individual laboratory experiments in the first place and to formulate the commercial procedure in the light of the foregoing results obtained. It may also be pointed out here that in comparison with plain-carbon spring steels silico-manganese spring steels require much greater care and attention, *e.g.* renewal and stirring of oil or water bath, uniformity of heat-treating temperatures and soaking, quick and proper manipulation of the transfer of the steel to the quenching media, etc. Silico-manganese steels are highly sensitive to these heat-treatment abnormalities.

Another factor for which separate research will be necessary, is the effect of "Austenitic grain Size" on the hardenability of silico-manganese spring steel bearing in mind that fine-Austenitic grained Steels are of shallow hardening types and coarse-Austenitic grained of deep hardening types. With an optimum Austenitic grain size much lower oil or water hardening temperatures may be quite feasible eliminating thereby risks of over-heating, decarburization, distortion, warpage, macro- and micro-cracking, etc., accompanying high-temperature heat treatments.

1. Colbeck and Hanson, *J. I. S. I.*, 1924, **109**, No. I, 377. 2. Andrew, *Ibid.*, Discussion on the above paper, p. 395. 3. Baker, *Ibid.*, 1903, No II, p. 312. 4. Hadfield and Osmond, *Ibid.*, 1890, No. I, p. 62. 5. Andrew and Richardson, *Ibid.*, 1935, **131**, No. I, 129. 6. Burns, *Ibid.*, 1932, **125**, No. I, 363. 7. Charpy and Cornu, *Comptes Rendus*, 1913, **25**, 1240. 8. *Ibid.*, 1913, **117**, 319; *Revue de Metallurgie*, June 1915, **12**, 493. 9. Vigoroux, *Comptes Rendus*, 1913, **116**, 1374. 10. Guillet, *J. I. S. I.*, 1906, No. II; *Precisde Metallographie; Les industries Metallurgiques, a'l'avant guerre.*

GRANT FOR CANCER RESEARCH

A grant of £1865 (Rs. 24,837) has been made by the British Empire Cancer Campaign to Oxford University to be used for cancer research.

Professor A. D. Gardner, Regius Professor of Medicine at Oxford, in announcing this stated that during research into chemical substaces a new sideline has been found and Sir Robert Robinson, Waynflete Professor of Chemistry at Oxford, had wished to explore this, and for this purpose had applied to the British Empire Cancer Campaign for funds.

OBITUARY

PROFESSOR BIRBAL SAHNI, M.A., D.Sc., Sc.D., F.R.S.

THE news of the sudden death of Professor Birbal Sahni at Lucknow on 10th April 1949, came as an absolute shock to the scientific world; and the loss to India is truly irreparable. It is sad to think that the cruel hand of Death has taken him away from us at the comparatively young age of 58 when he was in the prime of his scientific career, and was looking forward to achieve higher ideals to raise and enhance the prestige and reputation of scientific work in India, and secure for her an honoured place in the international scientific world. The starting of an 'Institute of Palæobotany' in India which would be the first of its kind in the world, and serve as a centre of palæobotanical study and research of the highest order, was Prof. Sahni's life's ambition; during the 30 years of his scientific career, he had kept this objective in view, and dedicated himself entirely to this cause, and was eagerly looking forward to the day when he would be able to realise this ambition. On the 3rd of April 1949 when the Prime Minister of India, Pandit Jawaharlal Nehru, laid the Foundation-Stone of the 'Institute of Palæobotany' at Lucknow, it was indeed a great event in Prof. Sahni's life as the fulfilment of his one great ideal; that he should have been snatched away by Death almost within a week after this event, makes his demise really tragic.

After a brilliant educational career in India, the young Birbal Sahni went abroad for higher studies in Botany, and soon won the highest academic distinctions in his subject in the universities of London and Cambridge. During the latter part of his stay there, he was actively engaged in research and published a number of papers which immediately secured great recognition, and marked him out as one of the outstanding members among the younger botanists of those days. The young Dr. Sahni soon developed a special interest in the study of fossil plants, and naturally joined the famous Cambridge School of Palæobotany under the inspiring leadership of Sir Albert Seward. It did not take very long for the learned professor to discover that in Sahni, he had a most promising and enthusiastic worker who fully deserved his special care and attention; and Sahni soon became one of Steward's 'pet pupils'. Thus was Sahni initiated into the field of Palæobotany; and what he has achieved as a palæobotanist during these 30 years bears eloquent testimony to the manner in which he fulfilled the highest expectations of his eminent teacher. To Sahni, Seward was at all times his 'revered *guru*'.

Prof. Sahni will always be remembered for his outstanding work in the field of Palæobotany, and it is no exaggeration to say that the study of Palæobotany in India on modern lines really started with him. During his stay in Cambridge, Sahni had already published several papers on fossil plants; and one of his best known earlier works was his study of the petrified plant remains from the Queensland Mesozoic and Tertiary Formations, published in 1920. This Australian material really came to Prof. Seward for description; but he passed it on to Sahni with the confidence that the young man would be able to deal with it quite efficiently. When the work was completed and Sahni had prepared his paper, Seward passed it on to the Queensland Geological Survey for publication; and in doing so, wrote as follows: "Prof. Sahni devoted himself with his accustomed thoroughness to the work of describing the plants and to the problems that were raised, and after a perusal of the paper he has furnished I must express my appreciation of the able manner in which the investigation was carried out." Another important paper published by Dr. Sahni also in the same year was the one on "The structure and affinities of *Acmopyle Pancheri*" in the *Transactions of the Royal Society*, in which after giving a detailed account of the monotypic New Caledonian genus *Acmopyle*, he discussed with remarkable lucidity some of the most controversial questions like the systematic position of the Taxineæ, the morphology of the ovuliferous scale of Conifers, and the origin of the Conifers themselves. His resolving the Gymnosperms into two divisions—Phyllosperms and Stachyosperms—is recognised as an important contribution in interpreting the evolutionary relationships of this interesting group.

It was also in the year 1920 that a Memoir on "Indian Gondwana Plants: A Revision" was published in the Palæon-

tologia Indica Series under the joint authorship of Seward and Sahni; and this may be taken as the starting point for the study of Indian fossil floras on modern lines. After imbibing the best traditions of the Cambridge School, and having worked in such close association with Prof. Seward, Dr. Sahni resolved on his return to India to dedicate himself entirely to the study of Indian fossil plants; and this he did with remarkable devotion and conspicuous ability till the last day of his life.

Starting with this idea nearly 30 years ago, the first thing that Sahni did naturally was to take stock, as it were, of the existing position of Indian Palæobotany, and visualise the possibilities of further work. This he did in 1922 in his Presidential Address to the Botany Section of the Indian Science Congress on "The present position of Indian Palæobotany". In the course of this address he said: "My own interest in palæobotany raises the hope that I may help to bring this fascinating subject more prominently to the notice of my countrymen; and perhaps even succeed in inducing a large number of them to turn their attention to the rich field that it offers for original investigation. With this end in view I propose to devote my address to a brief review of the present position of Indian Palæobotany". The stream of papers on Indian fossil plants by himself and his students which has continuously flowed from Lucknow during these 30 years shows how fully he had succeeded in realising the hopes which he entertained in 1922. It is hardly possible in the course of this short Note to review and give an account of all this output of research by Sahni and his collaborators; suffice it to say that the Lucknow School of Palæobotany under the inspiring leadership of Prof. Sahni gradually came to be recognised as one of the foremost centres of palæobotanical research, and was looked upon in this part of the world with the same regard and recognition as the Cambridge School under Prof. Seward.

The one important point which Prof. Sahni recognised was that all palæobotanical studies must be made in relation to the geological and geographical conditions under which the plants under investigation lived and died; and that without a proper understanding and appreciation of this geological background, the study of fossil plants loses practically all its vital interest. Thus it happened that Prof. Sahni gradually got more and more interested in geological studies, and he spared no pains in understanding the geological setting of the fossil plant material which he was studying from time to time. This rational line of approach has been most fruitful, and accounts for the very great interest and importance of many of his studies both to the botanist and to the geologist.

A very large amount of work done by Prof. Sahni relates to the study of the Gondwana floras; and in this field, he was an acknowledged authority. Apart from the description and identification of these fossil plants which in itself was a most valuable contribution, he dealt with some of the more fundamental problems connected with the Gondwana floras such as their origin, distribution, evolution, and relationship with the other contemporary floras. Among the more important of such contributions may be mentioned (i) The Southern Fossil Floras, a study in the plant-geography of the past; (ii) Permo-Carboniferous life-provinces, with special reference to India; (iii) Wegener's theory of Continental Drift in the light of palæobotanical evidence; (iv) The relation of the Glossopteris Flora with the Gondwana glaciation; and (v) Recent Advances in Indian Palæobotany. In each of these papers, he has given us a masterly review of the latest position in the light of his own work, and indicated new angles of vision for further studies. His memoir on "*Williamsonia sewardiana* sp. nov. from the Rajmahal Hills," in which he gave an entire reconstruction of one of the first known Indian fossil cycads is recognised as an outstanding contribution from India to our knowledge of this very interesting group of Mesozoic Cycadophyta. Equally important, from the point of view of the vexed problem of the origin of Angiosperms, is his memoir on "*Homoxylon rajmahalense*, gen. et sp. nov. also from the Rajmahal Beds."

From the way in which Prof. Sahni approached the study of fossil plants, it was only natural that many of the results of his work had an important bearing on several geological problems. His work on the flora from the Deccan intertrappean beds of the Nagpur-Chhindwara area and their age indications led to the famous controversy regarding the age of the Deccan

Traps. After about four years of discussion from all points of view, Prof. Sahni's contention, on the evidence of his fossil plants that the Traps are really Eocene and not Upper Cretaceous, has been generally accepted. A most comprehensive and fascinating account of this work was given by Sahni himself in his General Presidential Address to the Indian Science Congress in 1940. His latest work on the discovery of micro-fossils in the salt marl and associated beds of the Punjab Salt Range and their bearing on the 60-year old controversy regarding the age of this 'Saline Series,' is well known; and the Proceedings of the two Symposia on this subject held in 1944 and 1945 in which practically all the leading workers in this field both in India and outside have participated, bear ample evidence to the manner in which Sahni's work has stimulated worldwide interest as offering a conclusive solution to what has been a most intriguing and tantalising problem.

To one who was thus devoting all his time and attention to scientific research and was making several notable advances in our knowledge, it was only natural that the highest honours and distinctions in the scientific world came to be conferred upon him in quick succession from time to time. Prof. Sahni was a Foundation Member of many of the scientific bodies in India, and always played a most effective part in promoting and upholding the highest traditions of scientific research in this country. He frequently went abroad in response to invitations for participating in congresses and conferences concerned with palæobotany; only a few days before his death, he was elected as the President of the International Botanical Congress to be shortly held at Stockholm,—but, alas, he has not lived to occupy that Presidential Chair which, we are sure, he would have done with outstanding ability and distinction, adding to India's glory in the international scientific world.

As a scientist, Prof. Sahni was known for his thoroughness in looking into every detail of the investigation; and whether it was his own work or that of others, he insisted on being satisfied on every point of observation, illustration, or discussion, before he would pass it for publication. What he said of another eminent palæobotanist is equally true of himself: "Like all cautious workers, he was difficult to convince....but was by no means of the type that clings to pet theories". For clarity of presentation, lucidity of argument, and due consideration for the 'other point of view', Prof. Sahni's papers are a model for others to follow. A great feature of Dr. Sahni's work as a man of science, was that apart from his own personal investigations, he had organised a School of Research at Lucknow where a team of young and enthusiastic students had gathered round him and carried out original work of the highest order under his personal care and attention. Every worker in the field of palæobotany and allied subjects in India looked up to him, at some time or other, for help and guidance. Singularly free from all passions and prejudices, personal or provincial, Prof. Sahni gave of his best to every one of these workers promptly and generously; and all of them recall with regard and affection the many acts of kindness which they have received at his hands.

Apart from the greatness of his accomplishments as a scientist, Dr. Sahni's human qualities of kindliness and friendship were really unique. Belonging to a noble and highly cultured family, he possessed a most amiable and charming personality, and endeared himself to one and all alike. To see him, was to like him; to know him, was to love him. Those that had the privilege of enjoying the genial hospitality of the Sahnis at Lucknow know how fondly they were attached to each other, and had built up for themselves a home with an all-pervading atmosphere of peace, happiness, affection, and goodwill.

The late Prof. Sahni has left behind him a glorious record of scientific work; and by his untiring endeavours, he has laid the foundations for the study of Indian palæobotany trulp and well. The 'Institute of Palæobotany' which will grow up in Lucknow will live for ever as a fitting monument of his achievements and aspirations in the cause of Palæobotany, and serve as a perpetual source of inspiration to workers from all parts of the world in this fruitful and fascinating field of study and research which he so richly adorned.

L. RAMA RAO.

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SUNSPOTS AND COSMIC RAY INTENSITY

IN recent decades, Sunspots have been observed to influence C.R.I. (Cosmic Ray Intensity). Finer observations have shown that C.R.I. first increases and then decreases whenever a major Sunspot appears.

Considering the phenomenon to be inexplicable by the existing theories, Alfven[1] has offered a new explanation. He explains C.R.I. variations in terms of changes in Earth's electrostatic potential, which, he assumes, are caused by the approach of an ion-cloud from above a solar-flare. This gets polarised due to the solar magnetic field. The preceding +tive pole induces −tive potential in the Earth, which changes to a +tive one as the tail of the cloud approaches. The initial −tive and the subsequent +tive e.s. potentials of the Earth cause an initial increase and the final decrease in C.R.I., because the Cosmic Rays are more abundantly +tive.

The ion-cloud would take, as Alfven also thinks, about 24 hrs. to travel from a solar-flare to the Earth. Thus, on his hypothesis, we expect :—(i) an initial increase in C.R.I., about 24 hrs. after the observation of the solar-flare, and (ii) a subsequent decrease, a day or so after this increase.

The observational facts do agree with this sequence of variations. But Alfven's theory shifts the whole phenomenon by about 24 hrs., as the following table (based on ref. 2, 3, 4) reveals.

Occurrence	Observation of Solar-flare	C.R.I. increase	C.R.I. decrease	Commencement of Mag. Storm
February-March 1942	28th Feb. 11 h. 54 m.	28th Feb. 14 h. 30 m.	1st March 6 h. 50 m. (App.)	1st March 7 h. 27 m.
July 1946	25th July 17 h. 30 m.	25th July 18 h. 15 m.	26th July 18 h. 0 m. (App.)	26th July 19 h. 0 m.

It is clear from this, that the ion-cloud which takes about 24 hrs. to travel to Earth, cannot cause the initial increase, which takes place within two-three hrs. of the flare-observation. This increase requires, for its explanation, an agent which posses-

ses a much greater velocity. Will not some part of solar-spectrum answer the call—for example the u.v. rays? These radiations are given out in great abundance from above Sunspots. Hence there is nothing wrong in assuming u.v. rays to be the cause of the C.R.I. increase.

The final decrease may be due to the electron-cloud that will take some time to reach the Earth, and will induce +tive potential in it, which will, therefore, repel the +tive component of Cosmic Rays, and thus cause decrease. The same electron-cloud gives rise to the main Magnetic-Storm.

It may be added that the disturbances in the long range radio-wave propagation have been analysed into those occurring almost simultaneously with the observation of the flare and those which follow about a day later. These two phases of a single phenomenon have also been explained in terms of the u.v. rays and the ionic radiations respectively.[5]

Delhi, KULDIP CHAND CHADHA.
January 31, 1949.

1. Alfven, *Nature*, 1946, **158**, 618. 2. Duperier, *Proc. Phys. Soc.*, 1945, **57**, 464; Dolbear and Elliot, *Nature*, 1947, **159**, 58. 3. Duperier, *Ibid.*, 1942, **149**, 579. 4. *Pub. Astr. Soc. Pac.*, 1946, **58**, 315; *Observatory*, Dec. 1946. 5. Wells, *P. I. R. E.*, 1943, **31**, 147.

NUCLEAR MAGNETIC RESONANCE AND THE EFFECT OF THE METHODS OF OBSERVATION*

THE successful observation of nuclear paramagnetic absorption and nuclear induction depends primarily upon the fairly short relaxation times for the nuclei. This fact, *viz*, the short relaxation times being found for nuclei even in the case of crystals and extremely low temperatures is perplexing. According to the theory of Waller[1,2] regarding the interaction of spin and lattice or spin and spin the time required for the nuclei to come to thermal equilibrium is very large being several hours at the least and running to geological orders of magnitude in other cases ($\gtrsim 10^6$ years). What then is the process by which excited nuclei return to the lower states and what happens to the energy so liberated? Having examined the problem in the light of the above question we find that the very method of observation so far used can to a large extent account for the extraction of energy from excited nuclei. The methods of observation consist in placing the sample in a tuned resonant circuit. The precessing nuclei can all be considered as small resonant circuits and all being coupled to the external circuit. It can be seen that in such a system there will be transformer action and there will be an induced E.M.F. in the external circuit. This is in effect what is observed in nuclear induction experiments. Due to the induced current in the circuit and the finite Q of the circuit there will be losses in the circuit. So there may be a transfer of energy from the inner circuits to the outer circuits.

Considering the nuclei as precessing nuclei also we find that an induced E.M.F. is set up and a consequent loss in the external circuit.

We can make a few simple calculations here instead of going to lengthy rigorous calculations. We have to find the energy lost in the circuit per sec. and the energy available from the nuclei, and by dividing one by the other we can find the time required for all the nuclei to return to their normal states.

We can calculate that the voltage induced is of the order of 1 m.v.[3] and if the Q of the circuit is say 10 then the energy lost per sec. or power loss is $\frac{V^2}{2\omega LQ}$, where V is the voltage, ω is the angular frequency, L is the inductance. This comes out to be of the order of ($V = 1$ m.v., $\omega = 2\pi 40 \times 10^1$, $L = 1 \times 10^{-6}$) 2×10^{-10} watts in a typical case. The energy available in a typical sample say of hydrogen is no. of nuclei $\times 2\mu H$ (where μ is the magnetic moment and H is the field) which comes to be the order of $10^{16} \times 2\mu H = 10^{15} \times h\nu = 10^{15} \times 6$. $10^{-27} \times 40 \times 60^6 = 2 \times 10^{-3}$ ergs, 2×10^{-10} watt sec., 2×10^{-10} joules. Therefore the time required for 2×10^{-10} joules to dissipate at the rate of 2×10^{-10} watts is 1 sec. Thus it is seen that the very existence of the tuned circuit can to a large extent affect the observations. The exact value of the time required depends upon the relationship existing between the individual nuclear spins and their relationship to external fields, crystalline fields, etc. This time will be lengthened to some extent by

the decreasing induced E.M.F. as time goes on and loss of coherence between the nuclei. However it is seen that effects of the methods of observation are very important as regards nuclear–paramagnetic–radio-frequency experiments. Here it is found that this part of the time depends upon the Q of the circuit and so experiments may be devised to test the influence of the Q of the circuit.

Indian Institute of Science, Bangalore, *March* 11, 1949. G. SURYAN.

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* *Proc. Ind. Sci. Cong.*, Allahabad, Jan. 1949, p. 15.

1. Waller, I., *Z. f. Physik*, 1932, **79**, 370. 2. Heitler and Teller, *Proc. Roy. Soc.*, 1936, **155 A**, 629. 3. F. Bloch, W. W. Hansen and Packard, *Phys. Rev.*, 1946, **70**, 474.

PURITY OF MILK

THE surface tension of milk and its dilutions with water and the effect of starch on their surface tension have been studied in order to find out a suitable physical method for determination of purity of milk, as the Lactometer (commonly used at present) hopelessly fails to detect (*i*) presence of water in the diluted milk when some suitable quantity of starch or similar substance is added to it as an impurity or (*ii*) skimmed milk when a suitable quantity of water is added to it.

The surface tension was determined by the weighing drop method at a fairly constant temperature. The surface tension of milk varied with its dilutions with water as follows:—

Temp.	% water in milk	Surface tension in dynes/cm.	Remarks
17·5° C.	0	56·3	The bazar milk was used.
,,	20	56·7	
,,	40	57·4	
,,	60	58·4	
,,	80	60·7	
,,	100	73·4	

The starch and similar other impurity have no effect on their surface tension. A set of observations is given below for reference.

Temp.	% starch in pure milk	Surface tension in dynes/cm.	Remarks
215·5° C.	0	57·3	The new sample of bazar milk used.
,,	1	57·3	
,,	2	57·4	
,,	5	57·4	
,,	10 (saturated)	57·5	

Thus the purity of milk can easily be detected by measurement of its surface tension. An instrument (the patent applied) based upon the above results serves well for the purpose of finding purity of milk.

Furthur work in detail is in progress and shall be published in due course of time.

The authors are indebted to the Government of Patiala and East Punjab States Union, Patiala, for providing facilities to conduct this work.

Meteor. Observatory & Research Laboratory, *April* 22, 1949. L. D. MAHAJAN, O. C. MATHUR.

ELASTIC CONSTANTS OF SODIUM CHLORATE AND SODIUM BROMATE

THE behaviour of sodium chlorate and sodium bromate is peculiar in many ways. The relatively larger bromate ion indicates according to Bragg's contact law for ionic distances that the elastic constants of the bromate should be lower than those of the chlorate. Nevertheless, the very much higher melting point of the bromate ($381 \pm 6°$ C.) over that of the chlorate (248° C.) indicates larger forces of affinity in the bromate. The elastic data provided by Bridgman (1929) and Mason (1946) show that the elastic constants of the bromate are higher. Because of this peculiar behaviour, it is considered desirable to repeat the measurements on the two substances. The results are given below.

The two substances crystallise in the cubic tetartohedral space group T and are piezo-electric. The necessary sections are cut out from well-grown good crystals of the same and the ultrasonic method described by the author (1948) is used. The values obtained in the investigation along with those of other experimenters wherever available are given in the following table.

No.	Substance	Author	C_{11}	C_{12}	C_{44}	s_{11}	s_{12}	s_{44}	β
1	$NaClO_3$	Voigt	6·19	−2·087	1·196	24·6	+12·52	83·6	150·0
	,,	Mason	4·90	1·386	1·17	23·35	− 5·15	85·4	39·1
	,,	Bhagavantam & Suryanarayana (1947)	5·09	1·18	1·18	22·9	− 5·35	84·7	36·6
	,,	Author	4·92	1·45	1·19	23·5	− 5·30	84·1	38·7
	,,	Bridgman	..	..	..	..	..	..	50·4
2	$NaBrO_3$	Mason	6·16	2·356	1·54	20·6	− 5·7	65·0	27·6
	,,	Author	5·45	1·91	1·50	22·4	− 5·8	66·7	32·4
	,,	Bridgman	..	..	..	..	..	..	44·1

The values of the elastic constants C's are given in units of 10^{11} dynes/cm.^{2}; of the elastic moduli s's and the compressibility β in units of 10^{-13} cm.^{2}/dyne.

β is calculated from the formula

$$\beta = 3(s_{11}+2s_{12}).$$

Mason's values of s's are taken from the tabulated results in the case of $NaClO_3$; for $NaBrO_3$ they are read off from his graphs corresponding to the temperature 28° C., since no tabulated results are given in the latter case. While there is good agreement in the results of $NaClO_3$, there is some discrepancy in those of $NaBrO_3$. This is partly due to the graphical results since a similar discrepancy is found to come out for $NaClO_3$ also if the s's are taken from the graphs for $NaClO_3$ instead of from the table provided in Mason's paper.

However, the fact of the higher elastic constants of $NaBrO_3$ is definitely established. While no certain reason can be advanced for the curious behaviour, especially in view of the fact that the X-ray values of the ionic distances in $NaBrO_3$ are very much less clearly established than in $NaClO_3$, the higher elastic constants of the former may be attributed to the lesser distance between the Na and Br atoms in $NaBrO_3$ making the interionic distance in $NaBrO_3$ less than in $NaClO_3$. From Zachariasen's (1929) values of the parameters for $NaClO_3$, we get the distance between Na and Cl as

$$D_{Na-Cl}=4\cdot017 \text{ Å}$$

whereas from the parameters accepted by Wyckoff (1931) for $NaBrO_3$ we get

$$D_{Na-Br}=3\cdot718 \text{ Å}.$$

The author expresses his thanks to Prof. R. S. Krishnan for his kind interest and helpful discussion. The author's thanks are also due to Miss C. Santhakumari for kindly lending the crystals.

R. V. G. Sundara Rao.

Physics Department,
Indian Institute of Science,
Bangalore,
May 18, 1949.

1. Bhagavantam, S., and Suryanarayana, D., *Phy. Rev.*, 1947, **71**, 553. 2. Bridgman, P. W., *Pro. Am. Acad.*, 1929, **64**, 51-73. 3. Mason, W. P., *Phy. Rev.*, 1946, **70**, 529. 4. Sundara Rao, R. V. G., *Pro. Ind. Acad. Sci.*, 1948, **28**, 475. 5. Voigt, W., see Ref. 1. 6. Wyckoff, R. W. G., "The Structure of Crystals," 1931. 7. Zachariasen, W. H., *Zeit. f. krist.*, 1929, **71**, 517.

PRODUCTION OF p-CYMENE FROM CARENE

According to a French patent,[1] p-Cymene is prepared by treating turpentine oil with a sulphate of iron in a tube furnace at 175°-250° C.

We have recently subjected carene (b.p. 163°–168° C./745 mm., d_{15}^{19}: 0.8468, n_D^{20}: 1·4716) from Indian turpentine *Pinus longifolia*, to pyrolysis test at 250° ± 15°C, liquid hour space velocity: 0.14, using partially dehydrated ferrous sulphate (8-10 mesh) catalyst.

The catalyst is prepared by heating $FeSO_4$ 7 H_2O in the reaction chamber at 250°±15° C. for 3 hours. Other experimental details are given in previous communications.[2,3]

After a single pass of carene over the catalyst, the yield of p-Cymene on the basis of two-fold fractionation and terpene fed is 30·7%, containing 25-30% unsaturates.

It is therefore concluded that partially dehydrated ferrous sulphate serves as a catalyst, not very active, for dehydrogenating

carene to p-Cymene. Also, it suffers from a great disadvantage as it turns powdery after a single pyrolysis.

Technical Chem. Lab., Forman Christian Coll., Lahore, *December* 4, 1948.

JAMES VERGHESE.
H. K. SONDHI.
BHARAT BHUSHAN.
M. L. JOSHI.

1. Henri Lavoisier (D. Gardner inventor), French Pat. 797, 793, May 4, 1936. 2. James Verghese, Bharat Bhushan, K. C. Gulati and M. L. Joshi, *J. Indian Chem. Soc.* (*Ind. & News Ed.*), 1944, **7**, No. 2, 93. 3. H. K. Sondhi, Bharat Bhushan, K. C. Gulati and M. L. Joshi, *Ibid.*, 1947, **10**, Nos. 1 & 2, 17.

POTASSIUM PERSULPHATE AS INITIATORS OF POLYMERIZATION IN SOLUTION

PERSULPHATES though extensively used as catalysts in emulsion polymerization have seldom been studied as catalysts in solution polymerization owing to the difficulty of getting the persulphate in the dissolved state in the usual organic solvents. We have observed that it is possible to carry out the reaction in diethylene glycol with dissolved persulphate and have studied the polymerization of styrene at 80° C. in this solvent. The results obtained however are quite unexpected and warrants the publication of this preliminary report though the detailed results are to be published later elsewhere.

Some typical results are summarised in the table below :—

TABLE

Concentration of catalyst (per cent. on the weight of monomer)	Speed of initial reaction (per cent. conversion per min.)	Intrinsic viscosity
$K_2S_2O_8$ 0·06 per cent.	0·45	0·6—1·2
0·022	0·2	
2·7 per cent. benzoyl peroxide	0·18	0·2—0·4

It will be observed from the data presented that weight per weight potassium persulphate is a far stronger catalyst than benzoyl peroxide. In fact, roughly speaking one molecule of the persulphate equals the catalytic power of over one hundred molecules of benzoyl peroxide. This is quite remarkable, which is however made more striking by the fact that this high yield is not obtained at the sacrifice of the molecular weight which is usually the case. It will be observed from the intrinsic viscosity values given that while the values of $[\eta]$ with benzoyl peroxide is about 0·2–0·4, the persulphate polymer is about three times that of the benzoyl peroxide polymer, which calculated in molecular weight according to Staudinger-Mark equation,[1] $[\eta]=kM^a$, where $a=0\cdot62$ and $k=3.7\times10^{-4}$ for toluene, means that the molecular weight of the former is 5·8 times more than the latter. The average molecular weight of the polystyrene produced from persulphate is about 64,000 which strikes as unusually high for such a dilute solution of monomer (16·7% by volume).

The above results make it imperative that in any attempt to explain the unusually high speed and high molecular weight in emulsion polymerization,[2] account should be taken of the contribution made by this inherent capacity of potassium persulphate to promote speed and chain length as demonstrated above. We have also observed that the persulphate-catalysed styrene polymerization is fairly strongly inhibited by oxygen of the air, a phenomenon which is commonly encountered in emulsion polymerization.

It seems that the observed high efficiency of the persulphate is not solely due to a higher rate of initiation as this will produce a lowering of average molecular weight but probably due to the fact that among the usual processes of termination of free radicals, (*a*) $M^{\cdot}_n + M^{\cdot}_s \rightarrow M_{n+s}$, (*b*) $M_n^{\cdot} \times Cat^{\cdot} \rightarrow M_nCat$ and (*c*) $Cat^{\cdot} + Cat^{\cdot} \rightarrow Cat_2$ (where $Cat^{\cdot}$ is the free radical produced by catalyst decomposition), the reaction (*b*) is more predominant than reaction (*a*), and in the case of persulphate the speed of reaction (*b*) is comparatively slow. Another factor of importance which might contribute to the superiority of the persulphate is the fact that the inorganic persulphate is stable enough to successfully stand the onslaught of its own free radical whereas the organic peroxide sustains a

concurrent wastage by such attack as shown by Nozaki and Bartlett.[3]

RANAJIT SENGUPTA.
SANTI R. PALIT.

Ind. Asso. for the Cultivation of Science, Calcutta-12, India,
January 4, 1949.

1. Goldberg, Hohensten and Mark, *J. Poly. Sci.*, 1947, **2**, 503. 2. Price, *Reactions at Carbon-Carbon Double Bond*, p. 103, Interscience Publishers, New York, 1946. 3. Nozaki and Bertlett, *J. Amer. Chem. Soc.*, 1946, **68**, 1686.

PYROGENIC DECOMPOSITION OF CARENE IN THE PRESENCE OF COPPER AND ALUMINIUM CATALYSTS

ON passing the vapours of carene (b.p. 163-68° C./745 mm., d_{15}^{15}: 0·8468, n_D^{20}: 1·4716, from Indian turpentine, *P. longifolia*) through copper turnings heated to 400° ± 15° C.[1] in the pyrogenic unit previously described,[2] at an hourly liquid space velocity: 0·14, the terpene hydrocarbon was decomposed. Among the reaction products were 8.8% gases and 89·2% oil. 20·3% of the pyrolysate distilled between 173-78° C./745 mm. (d_{15}^{15}: 0·8697, n_D^{20}: 1·4775) and contained *p*-cymene.

With aluminium turnings, the gases amounted to 12·3% and oil 83·7%. The yield of the 173-78° C./745 mm. fraction was reduced to 18·5% (d_{15}^{15}: 0·8699, n_D^{20}: 1·4797).

The experiments suggest that a furnace of copper[3] or aluminium will have a gentle accelerating effect on the disproportionation of carene to *p*-cymene.

Tech. Chem. Lab., Forman Christian Coll., Lahore, *December* 21, 1948.
JAMES VERGHESE.
H. K. SONDHI.
BHARAT BHUSHAN.
M. L. JOSHI.

1. See Orlov, "Pyrogenic oxidation of turpentine in the presence of a copper catalyst," *Ukrainski Khem. Zhurnal*, 1926, **2**, 11; *Chem. Zentr.*, 1926, II, 660. 2. Sondhi, Bhushan, Gulati and Joshi, *J. Indian Chem. Soc.* (*Ind. and News Ed.*), 1947, **10**, Nos. 1 & 2, 17. 3. See Kirkpatrick (to Hercules Powder Co.), U.S. Pat. June 25, 1946, 2, 402, 898.

ON THE NATURE OF INHIBITION OF ERYTHROCYTE PYROPHOSPHATASE BY VERONAL-ACETATE BUFFER

IT was previously reported[1] that the erythrocyte pyrophosphatase is greatly inactivated by incubation for ½ hr. with M/35 veronal-acetate buffer alone, prior to the addition of the substrate and the activator; and that the presence of the activator (Mg^{++} ion) protect the enzyme from such inactivation to a certain extent. On further study on the nature of the inactivation it was discovered that both the buffer constituents, *viz.*, veronal and acetate, are themselves responsible for the inactivation to a great extent, the inactivation due to heat (38° C.) being comparatively small (Table).

1 ml. of 1 in 20 hæmolysate (human erythrocytes) was incubated with 3 ml. of the inhibitor of different concentrations for varying periods of time, and then the enzyme activity was determined by adding 1 ml. of 0·1 M $MgCl_2$ and 0·5 ml. of 0·01 M sodium pyrophosphate. Period of hydrolysis—15 mins. pH—7. Temp.—38° C. Percentage of inhibitions were calculated from the orthophosphate content of the trichloracetic acid filtrates.

TABLE

Enzyme incubated with	Per cent. inhibition produced		
	preliminary incubation period 15 mins.	30 mins.	60 mins.
0·2 M Sodium acetate	60	80	..
0·1 M ,, ,,	..	68	87
0·04 M ,, ,,	..	33	62
0·04 M Sodium veronal	..	76	88
0·02 M ,, ,,	..	42	62
0·01 M ,, ,,	..	22	34
Water ..	4	6	13

It was further observed that the pyrophosphate ion affords better protection of the enzyme than the Mg ion against the inhibition due to the buffer constituents.

A number of substances related to the buffer constituents were studied and varying degrees of inhibition were observed. All the solutions were adjusted to pH 7, and after incubating 1 ml. of the enzyme with 3 ml. of the inhibitor of varying concentrations for different time periods, the

activity was determined in *unbuffered* aqueous medium, the period of hydrolysis being reduced to 15 mins.

Among the narcotics studied, luminal is found to be more inhibitory than veronal. The inhibitor effect of acetate is increased by substituting acid groups like halogen or carboxyl (iodoacetate or malonate), while substitution of the basic amino group (glycine) almost abolished the inhibitor effect of the acetate. Alanine and phenyl-alanine produced no inhibition, but tryptophane, tyrosine and crystine produced inhibition.

Besides the inhibitors already reported *viz.*, (1) formaldehyde, alloxan, iodoacetate, oxalate, malonate, and citrate, the following produced more than 50% (in some cases almost complete) inhibition after incubating the enzyme with decimolar solutions of the inhibitors for 30mins: sodium acetate, sodium monochloracetate, sodium butyrate, sodium lactate, sodium mandalate, sodium phenoxyacetate, sodium pyruvate, sodium maleate, sodium malate, sodium fumarate, sodium succinate, sodium aspartate, sodium tartarate, sodium glutarate, sodium glutamate, acetaldehyde, thiourea, guanidine, and creatine. Higher concentrations are required in the case of the following inhibitors:—acetamide and urethane (M), ethanol, methanol, and urea (2 M), and acetone (3 M).

The pyrophosphatases of optimum pH 7·6 of several animal tissues (liver, kidney, intestinal mucosa, brain, testes, spleen, and muscle of guinea pig) showed identity to the erythrocyte enzyme not only in their property of being inactivated by calcium, fluoride, formaldehyde, and ethanol, but also in being inhibited by ½ hr. incubation with veronal-acetate buffer.

Since the pyrophosphate ion protects the enzyme against the buffer inactivation it may be permissible to surmise that the buffer constituents as well as the substances related to them produce inhibitions by blocking the active centres of the enzyme from reacting with the substrate; the inhibitor effect depending upon a particular molecular structure and the extent of inhibition depending upon the nature of the groups in the molecule. Similar observations were reported in the cases of dehydrogenases[2] and lipases.[3,4]

Further work is in progress.

Dept. of Biochemistry, Andhra Medical College, Vizagapatam, *March* 14, 1949.

B. NAGANNA.

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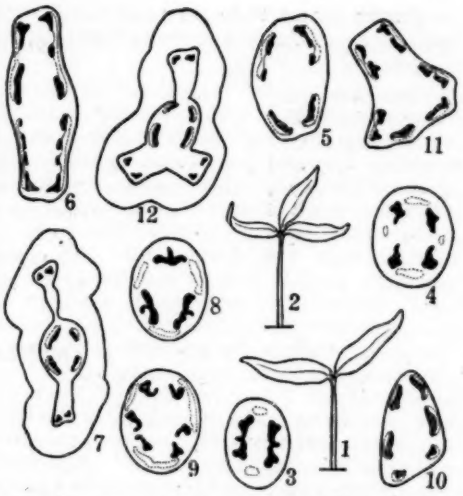
TRICOTYLY IN *CAPSICUM ANNUUM* VAR. *GROSSA* SENDT.

THE occurrence of two cotyledonary leaves in all dicotyledons is well known though instances are on record where recognisable seed-leaves are wanting or there is only one (Sargant, 1903). In the latter it is assumed that the two cotyledons were completely or partially fused. Compton (1913) has made a detailed study of syncotyly in several dicotyledons. While polycotyly is usual among Gymnosperms (Coulter and Chamberlain, 1910), it is rare in Angiosperms. The following note relates to such a condition noted by the writer recently in *Capsicum annuum* var. *grossa*, commonly known as red pepper.

In a culture of seedlings of *Capsicum annuum* var. *grossa*, which were raised for cytological work a solitary seedling showed the presence of three cotyledons instead of the normal two. The cotyledons were compared with those of a normally developing specimen of the same age. The cotyledons in the latter (Fig. 1) measured 3·2 × 0·8 cm. each and the angle of divergence between the point of insertion was 180°. In the tricotyledonary seedling (Fig 2) one of the three cotyledons measured 2·3 × 0·6 cm. while the other two were 2·3 × 0·45 cm. each; and the angle of divergence between the larger cotyledon and the other two was much greater than the angle between the larger cotyledon and the other two was much greater than the angle between the latter.

Anatomical observations were made in the tricotyledonary seedling and compared with a normal one. In a normal seedling the root in the early stages is diarch (Fig. 3). A little higher in the hypocotyledonary



(Protoxylem black; Metaxylem cross hatched; xylems of the node, seed leaves and plumule line shaded; Phloem dotted.)

FIG. 1. Dicotylous seedling of 20 days growth. FIG. 2. Tricotylous seedling of 20 days growth. FIGS. 3 to 7. Dicotylous seedling. FIGS. 8 to 12 Tricotylous seedling. FIG. 3. Transverse section of root. FIG. 4. Transverse section of the above at a higher level. FIG. 5. Transverse section below the node of seed leaves. FIG. 6. Transverse section just at the node. FIG. 7. Transverse section at the base of the seed leaves. FIG. 8. Transverse section of root. FIG. 9. Transverse section of the above at a higher level. FIG. 10. Transverse section below the node of seed leaves. FIG. 11. Transverse section just at the node. FIG. 12. Transverse section at the base of seed leaves.

region the two strands divide into four and appear tetrarch (Fig. 4). Very near the cotyledonary node the groups of xylem dilate (Fig. 5) to form a plate (Fig. 6). From the nodal plate two strands are separated on each side to form the vascular strands of each cotyledon and the remaining xylem plate is continued into the plumule as four plumular strands (Fig. 7).

The tricotyledonary seedling on the other hand showed a marked departure in the disposition of its xylem strands. The root at first is triarch (Fig. 8) and each one of these groups divides into two to become hexarch (Fig. 9). Just as in the normal seedling the xylem groups dilate in the vicinity of the node (Fig 10) and form the characteristic nodal plate (Fig. 11) from which the three cotyledons receive two strands each. The remaining xylem plate continues to form four plumular strands (Fig. 12) as in the case of normal seedling. The three double bundles to the three cotyledons are the continuation upwards of the three protoxylem groups of the root (Barton-Wright, 1932). It is significant that the points of origin of the double bundles from the nodal plate show marked disparity in their angle of divergence. Two of them are situated 80° apart and the third one is nearly 140° from either of these.

Discussion

Lobed cotyledons with varying degrees of splitting from an apical notch to deep cleavage have been reported by Compton (1913) in the members of Urticaceæ and Moraceæ. These have been cited as instances of Schizocotyly. The same author mentions that in a specimen of *Cannabis sativa* all the cotyledons were independent. In the plant under report all the three cotyledons are apparently independent and the anatomy of the root clearly shows a triarch structure. Each seed-leaf has its own root pole from which the protoxylem is continued upwards to the cotyledon. One cannot however ignore the difference in size of the cotyledons; one is slightly larger than the other two which are almost equal in size and there is also a significant difference in the divergence of the double strands from the nodal plate. These two features raise the question of the nature of the cotyledons in this case. Naturally the larger cotyledon should be regarded as one independent unit while the two smaller ones may be the result of fission of an originally single member at a very early stage.

The author wishes to express his grateful thanks to Dr. L. N. Rao for his kind encouragement, and to Dr. S. B. Kausik for helpful guidance and criticism.

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March 22, 1948.

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A NEW LEAF-SPOT DISEASE OF CASTOR *RICINUS COMMUNIS* L.

DURING the year 1947-48 a severe leaf-spot disease of Castor (*Ricinus communis* L.) was observed on the Castor crop in the Agricultural College farms at Kanpur. Preliminary microscopic examinations and cultures revealed the presence of a *Phyllosticta*. As no species of this fungus has been known to occur on Castor in India an investigation was conducted.

Symptoms.—During the month of July, after the commencement of the rains, minute dot-like light brown spots 0·1—0·3 mm. in diameter appear scattered on the upper surface of the leaf. These spots enlarge into prominent light brown circular lesions usually 0·4 cm. to 1·2 cm. in diameter, but some spots extend upto 2·5 cm. across (Plate I). A few spots are angular in shape. In some cases the spots coalesce

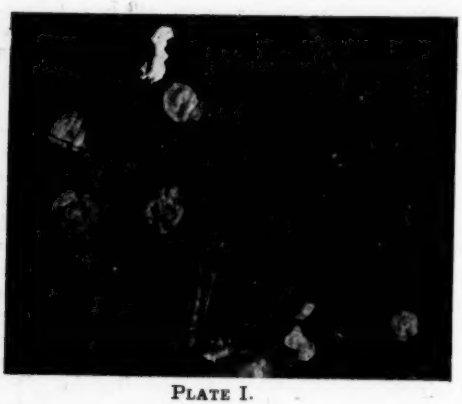

PLATE I.

forming irregular patches. The spots never cross the main veinlets radiating from the apex of the petiole. As the spots enlarge circular zonations of different shades of brown are formed. In many cases the centre becomes white, papery and brittle. Ultimately shot-holes appear in the centre. The spots become dry from the centre outwards. At the margin of the dry area a number of minute white dot-like structures appear in a ring. These gradually turn dirty brown ultimately becoming black and superficial within 48 to 96 hours. As the drying progresses successive concentric rings of such black dot like structures are formed. These are the pycnia of the fungus. As many as five pycnial rings have been observed. The spots attain the maximum size within 10 to 16 days. The spots are not formed on any other part of the plant.

Mycelium :—The mycelium is mostly intracellular and composed of hyaline, septate and branched hyphæ, 1·8-2·88 μ in breadth. The cells penetrated by the hyphæ loose their chloroplasts and are killed. After the death of the cells the hyphæ form small knots on the surface. These gradually enlarge and darken into the black elliptical pycnia measuring 25·2—97·2 $\times$ 14·2—42·2 μ. Sometimes a number of pycnia coalesce and measure 324 $\times$ 108 μ. The outer wall of the pycnidia is composed of dark brown pseudoparenchymatous hyphæ about 2-4 celled thick at the lower side, becoming many celled thick towards the upper surface. The ostiole is circular and usually situated on the top. It is without a beak. The conidiophores are situated at the base and lower sides of the pycnidial cavity. The pycnospores are biguttulate, hyaline with a greenish hue, elliptical and rounded at both ends. They are 4·32—10·8 μ long and 1·8—2.8 μ broad. In the presence of water, the spores are exuded through the ostiole in a musilagenous tendril.

Germination.—The spores germinate readily in water by giving out a germ tube from one end within 6-8 hours. The germ tube becomes septate between 8-12 hours.

Growth in culture.—The fungus grows well on Potato-dextrose-agar, Castor leaf decoction agar, Oat meal agar, and gives good growth in each. The colonies are white, circular and compact. After 4 or 5 days greenish dark spore masses appear scattered on the surface of the colony. These become black in a day or two. No pycnia are formed, the spores being produced at the apices of the hyphal branches.

Infection.—Inoculation experiments were conducted during moist humid days in the month of September. A large number of leaves were inoculated on both the surfaces with spore masses taken from culture and from infected leaf tissues. The inoculum was covered with cotton pads moistened with sterilized water. Spore suspensions from cultures were also sprayed on healthy leaves during the evening. In almost all cases infection took place. Within 3 days the inoculated parts became yellow, later becoming thin and brown, and within 8-10 days typical spots with pycnia were formed.

Infection on other parts of the plant was not successful even when the tissues were wounded.

Effect of various fungicides.—As the disease was severe during the year 1948 in the important experimental plots of the Government Economic Botanist (Oilseeds), various fungicides, *e.g.*, Bordeaux mixture (4: 4: 50), Perenox, Spergon (in concentrations recommended for leaf-spots by the respective manufacturers) were sprayed during the month of September. Although the spraying was late, the result was encouraging. In the case of Bordeaux mixture and Perenox the growth of the spots and the pycnial formation were checked. Phygon was less satisfactory, the spots gradually enlarged but no pycnia were formed on them. Spergon was found quite ineffective. A second spraying was given after 15 days with Bordeaux mixture and Perenox. No fresh spots appeared on the treated plants.

Identity of the fungus.—So far only one species of *Phyllosticta*, *P. ricini*,* has been recorded by Rostrop from Denmark. *Phyllosticta ricini* differs from the local species in having shorter and much broader ellipsoidal spores, measuring 6-7—3-4 μ. The species occurring at Kanpur is evidently a new one having oblong slender spores measuring 4·32—10·8×1·8—2·8 μ.

Phyllosticta bosensis. — Spots circular, brown, pycnidia on both sides, elliptical, black, erumpent ; pycnidia from infected plants 25·2—97·2×14·2—42·2 μ ; spores hyaline, one-celled, oblong, 4·32—10·8×1·8—2·8 μ, biguttulate.

Habitat.—In spots on the leaves of *Ricinus communis* L.

Phyllosticta bosensis.—Maculæ circulares, brunneæ ; pycnidia in utraque facie foliorum, elliptica, atra erumpentia ; pycnidia ex plantis infestatis 25·2—97·2×14·2—42·2 μ ; sporæ hyalinæ, uni-cellulatæ, oblongæ, 4·32—10·8×1·8—2·8 μ, biguttulatæ.

Habitat.—In maculis foliorum *Ricini communis* L.

The type specimen deposited in the Herbarium of the Government Agricultural College, Kanpur, U.P., and Indian Agricultural Institute, New Delhi.

We are thankful to Rev. H. Santapau of St. Xavier's College, Bombay, for the Latin rendering of the diagnosis.

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January 5, 1949.

* Saccardo, P. A., *Sylloge Fungorum*, **16**, p. 843.

LIFE-HISTORY, BIONOMICS AND CONTROL OF SAFFLOWER APHIDS (*MACROSIPHUM JACEACE* LIN.)

Safflower (*Carthamus tinctorius*) commercially an important oil-seed crop is cultivated in Bombay Province to an extent of 6,23,582 acres. Among the various pests that damage the crop are the leaf-eating caterpillars (*Perigea capensis* Gn.) and the aphids (*Macrosiphum jaceace* Lin.). The infestation by aphids is of considerable importance and in bad years, it may vary from 60-80% in Dharwar and Bijapur districts.

Life-history of *M. jaceace* Lin. was worked out under laboratory and field conditions. On an average, the reproductive capacity of a single apterous viviparous female was 29·5 in the first generation with a maximum of 56 young ones during the life period. The duration of life-cycle varied between 7·9 to 8·3 days with four moults. In Poona, *Macrosiphum jaceace* Lin. was observed breeding on the following host plants (1) *Arctotis grandiflora*, (2) *Calendulla*, (3) *Dahlia* (*Dahlia viribilis*), (4) *Ficus religiosa*, (5) *Guizotia abyssynica* and (6) *Callopsis tinctora*. Besides, large number of winged aphids were seen migrating on Ganja (*Cannabis sativa*) and Jute (*Carchhorus ultitorius*), during latter part of January and February.

During the early stages of the crop in November, the pest appears and later on increases considerably reaching to a peak about a week or two before the plants develop flower buds which commence during the last week of December or the first week of January when the average temperature in 1946-47 were 79·0 max. and 66·5 min. with 68·2% humidity.

It was observed that during January and February morning temperatures usually

fall considerably which increase as the day advances. To determine the effects of varying temperatures on aphid reproduction, observations were made to study the effects of broken temperatures on their reproductive capacity by subjecting them to low temperatures for a few hours followed by normal atmospheric conditions. Three hours exposures to low temperature practically did not produce any effects. However, exposure to low temperature for 5, 7 and 9 hours affected the rate of reproduction quite adversely.

Exposure for 3 hours

	Reproduction of insects under low temperature	Reproduction in control	Per cent. fall
Exposure for 3 hours			
Average ..	9·75	9·80	0·9
Exposure for 5 hours			
Average ..	10·26	14·10	27·2
Exposure for 7 hours			
Average ..	7·16	12·45	42·4
Exposure for 9 hours			
Average ..	7·10	11·65	39·3

Nature and extent of damage.— Observations regarding number of leaves, shoots, and heights of plants with different aphid populations on them indicated that with maximum aphid population of 568 to 1020 per plant the average Ht. of the plant was 16·8 inches with 23·5 leaves and 3·3 shoots as compared to 23·6" Ht., 82·2 leaves and 6·9 shoots in the insect-free plants.

By way of insecticidal control, fish-oil rosin-soap as well as nicotine sulphate yielded 90·91% knockdown within about 96 hours whereas DDT 0·2% spray, gammexane 0·2% spray and tobacco decoction gave about 82·0" mortality. Accordingly on an average, the plants treated with fish-oil rosin-soap and nicotine sulphate yielded 52·6 capsules and 1·4 oz. of seeds and 51·6 capsules and 1·3 oz. of seeds per plant respectively as against the plants treated with 3% DDT dust, 0.2% DDT spray and 5% Hexyclan dust which were almost at par and yielded on an average 40 capsules and 0·9 oz. of seeds per plant. The details of our finindgs will be published separately.

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February 4, 1949.

A COMPARATIVE STUDY OF THE CATALASE ACTIVTIY OF THE PETALS AND LEAVES OF *HIBISCUS ROSA-SINENSIS*.[1]

It was noted that in some of the veriegated plants, the catalase content of the albino patches of the leaf lamina was less than that of the green area. This initiated the present investigation to study the catalase activity of non-green plant organs like petals. In the present investigation, catalase activity of petals and young leaves of *Hibiscus rosasinensis* was measured and in order to further elucidate the role of the enzyme, the determinations were conducted in the early morning, noon and the evening of bright sunny days.

Experimental

For the determination of the catalase activity, the upper expanded portion (limb) of the petals were used. In case of leaves, lamina of young leaves (length 6 ± ·5 cm. and breadth 4 ± ·5 cm) of the terminal growing buds were selected.

The apparatus used was a modified Appleman's apparatus (Appleman [1]) and the general procedure was the same as employed by Pattanaik.[2] After a series of preliminary experiments the following detailed procedure was found suitable.

One gram of the material (leaf or petal) was macerated with 3 gm. of calcium carbonate and the pulverizing process was limited to 2 minutes. The pulverized material was diluted to 20 c.c. with the addition of distilled water and 4 c.c. of the diluted material was allowed to react with standard dilute hydrogen peroxide (neurtalised with sufficient amount of Ca-carbonate) in the reaction chamber. After the addition of the H_2O_2, the chamber was uniformly shaken for a period of 4 minutes and the amount of oxygen liberated was taken as an index of the catalase activity.

The temperature of the water-bath was kept at an uniform temperature of 30° C. for all the observations.

The data obtained in the investigation and meteorlogical observations are presented in the table.

TABLE

Observations on 4-10-1947 (The experiment was repeated on another Sunny day and more or less similar data were obtained

Time	Shade temperature °C.	Light	Catalase activity Oxygen liberated in c.c. (mean of three findings)		Katio : catalase activity of leaves/catalase activity of petals
			Petals	Leaves	
Morning 7·00–8·00	28·6	Bright sunlight	6·00	21·56	3·6
Noon 12·00–1·00	31·0	Intense sunlight	6·43	15·16	2·4
Evening 7·30–8·30	30·0	Dark	14·30	16·60	1·2

From the data it is clear that the catalase activity of the petals are less than the leaves. In case of the petals the catalase activity slightly increases in the noon but a sharp rise is obtained in the evening, when the flowers have started to fade. In case of the leaves, the results obtained for catalase activity are different. In leaves the catalase activity is high in the morning and the values obtained in the noon and the evening are comparatively low. The results obtained are interesting but further study is necessary before any explanation can be offered with reasonable accuracy.

My thanks are due to Principal Das, B.A. (Lond.), for the facilities provided for this work in the Sambalpur College and his valuable encouragement.

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March 3, 1949.

* Paper read at the Botany Section meeting of the Indian Science Congress, 1948.

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2. Pattanaik, S. N., *Curr. Sci.*, 1946, **15**, 196-97.

XANTHOMONAS DESMODII, A NEW BACTERIAL LEAF-SPOT OF *DESMODIUM DIFFUSUM* DC.

THE disease appears as yellowish brown, water-soaked, angular spots on the underside of leaves of *D. diffusum* used sometimes for green manuring at Poona. The pathogene differs from other bacterial leaf-spots of legumes in several respects and therefore it is proposed to assign it a specific rank *Xanthomonas desmodii* Uppal & Patel sp. nov.

Short rods with rounded ends, single or in pairs but never in chains; motile with a polar flagellum; capsule absent; no spores, no involution forms and non-acid fast; Gram negative; strict-aerobe; stains readily with common dyes. Colonies on neutral potato dextrose agar round, viscid, smooth, shining, wet, amber yellow with colourless margins and no internal markings. Excellent butyrous growth on potato cylinders and potato dextrose agar slants; odour is absent. Optimum temperature for growth lies between 25° and 30° C., maximum 38° C., minimum 11° C., while thermal death temperature about 50° C. Gelatin liquefied; starch hydrolysed; casein digested; litmus in milk reduced; milk peptonised; slight hydrogen sulphide produced. Ammonia and nitrites not produced; asparagine not utilised; blood serum not liquefied; no growth in Fermi's, Uschinsky's and Cohn's solutions. Acid but no gas in dextrose, galactose, lactose, mannite, maltose and sucrose; poor growth in salicin, arabinose, xylose, dulcitol, glycerol, raffinose and levulose.

Pathogenic only to *D. diffusum*, producing angular, yellowish brown leaf-spots and sometimes causing defoliation.

A detailed paper is being published elsewhere.

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March 28, 1949.

TRIALS OF U.S.A. HYBRID CORN (MAIZE)

IN 1947-48, 7¾ million acres were under cultivation of corn (maize) in India. Our estimated total yield was a little over two million tons, but 20% short of the demand, and 400,000 tons had to be imported from abroad. Our average yield in 1947 was

8 maunds per acre, which is 1½ maunds *lower* than the average yield per acre obtained during 1936-40. In the United States of America, during the corresponding period, the average yield per acre *increased* from 16 maunds (1930-34) to 25·3 maunds in 1946. This increase was achieved by the use of hybrid corn seeds. In 1933, hybrid corn seeds were sown in only one acre out of a thousand ; but by 1945, 675 acres out of a thousand were planted with hybrid corn. In that year, the increase of yield in the United States of America was some 17 million tons. Translated into increased income to the farmers, this meant 700 million dollars.

There are several research schemes on maize which have been sanctioned by the Indian Council of Agricultural Research, but it will take several years of co-ordinated work to evolve our own strains of hybrid corn suited to the different climatic regions of India. Experiments have recently been undertaken in this Laboratory to find out whether some strains of U.S.A. double cross hybrids could be utilised in India for increasing our yield of maize. Through the courtesy of Dr. Merle T. Jenkins, Washington, D.C , seeds were obtained for these experiments with three double crosses of hybrid corn (U.S. 13, Iowa 306 and Minhybrid 404), single cross parents of 306 and the inbred parents of all these strains.

Three sowings were undertaken at Almora on : (*i*) June 1st, (*ii*) June 25th, and (*iii*) June 28th, 1948.

In all these sowings the different strains of corn were planted in single rows 15 ft. long. The distance between plants was 18″. The distance between rows varied according to the area available : 2¾ ft. in (*i*) and (*ii*) and 3 ft. in (*iii*)

In the first two sowings at Almora, 12 strains of U.S.A. inbred parents, 2 single and three double crosses, open pollinated U.P. T. 41 and Almora local strain were sown, and in the third sowing three strains of U.S. double cross hybrids, T. 41 and one Almora local strain were sown in five replications.

Despite four sowings, one each of the four inbred parents of the double crosses did not germinate, and therefore only one single cross parent each of three double crosses was produced. The single cross parents of Iowa produced vigorous plants giving high yield of double cross hybrid seeds. The photograph, Fig. 1, shows the vigour of the single cross parents of Iowa 306, numbered 5 (AB) and 6 (CD), and a cob of 5 being pollinated by the tassel of 6.

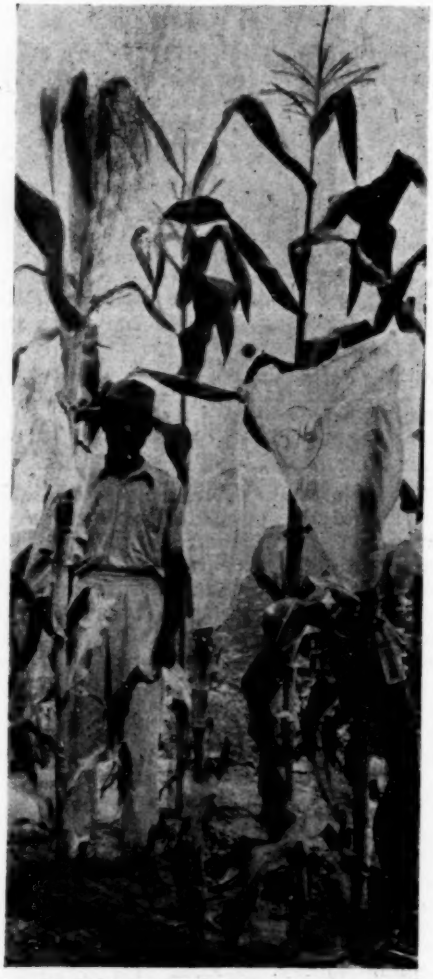

FIG. 1. Photograph of single cross parent plants of Iowa. × 306.

The average number of days required for emergence of tassel and silk in different strains of corn is given below (see Table).

It will be seen that the Almora variety was the earliest, but the life-cycles of the U.S. hybrid strains were shorter than that of U.P. T. 41.

TABLE I

Strain	Almora	Minhybrid 404	U.S. 13	Iowa 306	T. 41
Tassel ..	42·14	52·33	*55·61*	*55·87*	58·98
Silk ..	51·73	58·62	*62·73*	*61·76*	65·60

The average yield per plant of different strains is given in Table II (A), and the average yield per plot is given in Table II (B).

TABLE II

(A) Average yield per *plant*

Strain	U.S. 13	U.S. 306	T. 41	U.S. 404	Almora
Av. yield	9·09 oz.	6·73 oz.	3·91 oz.	3·01 oz.	0·77 oz.

C.D. = 0·80

(B) Average yield per *plot*

Strain	U.S. 13	U.S. 306	T. 41	U.S. 404	Almora
Av. yield	82·75 oz.	54·62 oz.	32·32 oz.	24·03 oz.	4·16 oz.

C.D. = 8·15

It will be seen that, compared to Almora local strain, the yield from all the other strains was far greater—U.P. T. 41 gave 407% and U.S. 13, 1080% higher yield. Compared to T.41, the observed yield of U.S. 404 was 23% less, but that of the other two U.S. hybrids was higher—U.S. 306, 76% higher, and U.S. 13, 132% higher. Fig. 2 reproducing mature cobs graphically shows this marked difference.

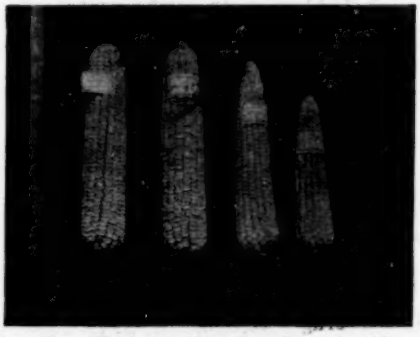

FIG. 2. Photograph of cobs of different strains of corn.
From left to right :—(i) U.S. 13 ; (ii) Iowa 306 ; (iii) U.P. T. 41 ; (iv) Almora local.

In view of the very high yield of the two strains of U.S. double cross hybrid corn observed in Almora, further experimental sowings with different strains of U.S. hybrid corn should immediately be undertaken throughout India, to find out types suitable for different regions. If positive results are obtained, we could more than make up our 20% deficit in corn production by the use of hybrid seeds, without increasing our corn acreage.

In the field work efficient help was rendered by Shri. Bansilal Sah and Shri. Udinath. The data were kindly analysed by Shri. A. R. Roy, Statistician (A.H.), I.C.A.R., New Delhi. The expenses of this work were met from a grant from the Department of Agriculture, United Provinces.

Vivekananda Laboratory, B. SEN.
Almora, U.P.,
March 30, 1949.

CULTURING OF PRO-EMBRYOS OF NORMAL DIPLOID CORN (MAIZE) AGED 3 TO 7 DAYS

HAAGEN-SMIT and others (1945) who worked on corn reported that 10 day-old corn embryos over ·3 mm. in length grew steadily in the culture medium. They, however, did not indicate the reaction in a culture medium of a pro-embryo less than 10 days old. In a younger kernel, the size of the embryo, it may be noted, is proportionately smaller. Further, it has been observed by previous workers, that as the size of the pro-embryo became smaller, there was a corresponding diminution in its response to the culture medium, even if the embryos were of the same age. Corn kernels collected 3 days after pollination were dissected under a dissection microscope. The seed was disinfected by dipping in S. T. 37 diluted 1 : 1 with water. The slide upon which the dissection was made and the forceps and the needles used for the dissection were all dipped in 70% ethanol and then passed over a flame before use. The method adopted by Haagen-Smit for dissecting the embryo consisted of holding the kernel between two slides, then cutting with a razor blade, and finally lifting the embryo out with a dissecting needle. The dissection had to be done under a dissection microscope as the embryo in this case was much younger and could not be located with the naked eye. The size of the embryo measured 70 microns in length and

32 microns in width and compares well with 0·1 mm. for length recorded for corn embryos aged 4 days (Randolph, 1936). Embryos from 4 days up to 7 days old kernels were similarly excised and all of them cultured in Tukey's general purose medium (Tukey, 1934) to which were added certain active growth-promoting ingredients indicated in the formula given below:

10 grams	KCl	To 1½ grams of this salt mixture, add 6½ grams of agar, 25 grams of sucrose and 1 litre of water.
2½	„ $CaSO_4$	
2½	„ $MgSO_4$	
2½	„ $Ca_3(PO_4)_2$	
2½	„ $FePO_4$	
2	„ KNO_3	

Proportion of Physiologically-Active Ingredients

0·2 mg. of adenine per litre of prepared solution.

20·0 mg. of ascorbic acid per litre of prepared solution.

25·0 mg. of succinic acid per litre of prepared solution.

3·0 mg. of glycine per litre of prepared solution.

0·1 mg. of nicotinic acid per litre of prepared solution.

0·5 mg. of pantothenic acid per litre of prepared solution.

0·2 mg. of vitamin B6 per litre of prepared solution.

The Tukey's medium was slightly modified by substituting 1 per cent. glucose with 5 per cent. sucrose, as sucrose is found to promote better embryonic growth in corn than glucose (Haagen-Smit, 1945). The culture bottles were kept in an incubator whose inside temperature was kept at 31° ± 1° C. The 3 to 6 day-old embryos were like tiny specks, making it hardly possible to measure their sizes with reasonable accuracy. The 7 day-old embryo, however, was conspicuous and large enough to measure. The growth measurements for this are recorded in the table below.

TABLE I

Embryos placed in the culture medium on Sept. 11, 1947

Date of measurement	Length of shoot mm.	Length of Root mm.
13-9-1947	2·0	1·9
14-9-1947	2·0	2·0
15-9-1947	2·1	2·0
16-9-1947	2·2	2·3
17-9-1947	2·3	2·4
18-9-1947	2·3	2·4
19-9-1947	2·3	2·4
20-9-1947	2·3	2·4
21-9-1947	2·3	2·4
22-9-1947	2·3	2·4
28-9-1947	2·3	2·4

The figures are averages for 5 embryos. It will be seen that the growth is very slow and retarded. At the end of the 5th day of culturing the growth, however, stopped. It was evident that the embryos of very young age, i.e., anything less than ten days, required some growth-promoting substance other than those supplied to the medium in the present experiment.

Discussion.—In this experiment it is evident that the young embryos aged 3 to 7 days were not able to mature because they lacked certain specific embryo factors necessary for further growth at this stage. It is also clear that the 7 day-old embryo was able to grow a little because it was fast developing to be autotrophic, but still wanting in certain growth hormones needed for full development. The physiologically active substances contained in the culture medium were perhaps able to supplement this deficiency to a certain extent but not fully. A similar case has been reported by White (1932). He was able to grow an embryo of *Portulaca oleracea* measuring only 0·12 mm. to a size of 1·84 mm. by adding a fibrin digest to his culture medium. The embryo, however, was unable to grow further at the end of the third week.

Agric. Res. Institute, Coimbatore, P. UTTAMAN.

April 5, 1949.

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THE LIFE-CYCLE OF *MONILIFORMIS MONILIFORMIS* (BREMSER, 1811), ACANTHOCEPHALA

ALTHOUGH morphological and taxonomic studies have been made on various Acanthocephala during the last three decades, little is known about their life-cycle. The development of *Macracanthorhynchus hirudinaceus* of pigs in beetle larvæ was described by Meyer (1931), and its life-history

was traced in the intermediate and definitive hosts by Kates (1943, 1944). In 1941, Burlingame and Chandler, and in 1946, Moore showed that the cockroach *Periplaneta americana* plays the role of the intermediate host for *Moniliformis dubius*, parasitic in rodents. *Moniliformis moniliformis*, which is also a normal parasite of rodents and occasionally the dog and man, is conveyed through the intermediation of the beetle, *Blaps mucronata* (Grassi and Calundruccio, 1888) and also the cockroach, *Periplaneta americana* (Seurat, 1912, and Southwell, 1922). Its occurrence in India has been recorded by Van Cleave (1925) and Bhalerao (1935). An investigation of the complete life-cycle of this thorn-headed worm was therefore considered useful.

Infective larvæ (Acanthellæ) were obtained from the body-cavity of naturally infected *P. americana* and fed in fresh condition to worm-free laboratory-bred rats. The rats were maintained under controlled conditions and autopsied after varying intervals of 1, 6, 12, 18, 41, 59, 62, 72, 128 and 147 days, and the parasitic stages were recovered and studied. In order to precisely determine the period when maturity was attained, the fæces of the infected rats were examined every day for the eggs of the worm, and it was found that in some cases the eggs appeared after 22 days and in others after periods extending up to 38 days. Thus it was observed that the *prepatent* period ranged from 22 to 38 days. In one instance, the eggs continued to appear in the fæces for 130 days. This *patent* period indicates the duration of the fecundity of the worms. The size and structure of the worms at different ages, the ratio between the number of larvæ ingested and of adults recovered, the sex-ratio, and their location in the host-intestine, have been studied in detail.

When full-grown, the males attain a length of 32-106 mm., whereas the females measure 69-230 mm., and as many as 6500 eggs were expelled with the fæces of a rat in a day.

The fertilised egg (Fig. 1), when extruded, has four envelopes and an embryo with numerous spines. Further development is possible only when the insect swallows the fæces containing these eggs. Inside its gut, the envelopes burst and the *acanthors* emerge. These make their way out of the gut and develop into the *acanthella* (Fig. 2) in the hæmocœle. This development inside the cockroach was experimentally studied by feeding laboratory-reared specimens of *P. americana* with the eggs of the worm. The exact duration of acanthor and acanthella stages was timed through 5, 7, 14, 21, 28, 35, 42 and 50 days after ingestion of eggs; of these, the first two yielded acanthor stages from the gut, and the rest pre-acanthella and acanthella stages from the body-cavity. The development of the embryo into the acanthor, its migration into the body-cavity, and the morphological changes involved in its development into an acanthella have been followed. The infective acanthella is enclosed in a delicate cyst and has a well-defined organisation in

FIG. 1

Photomicrograph of egg of *M. moniliformis*, fresh from fæces of experimental rat. ×330.

FIG. 2

Photomicrograph of infective acanthella of *M. moniliformis* from body-cavity of *P. americana*, without enveloping cyst. ×30.

which even sex-differentiation has taken place.

A detailed account of the above, a discussion of epidemiological considerations such as the viability of eggs and acanthellæ *in vitro*, the mode and conditions of transmission, the intensity of infections as assessed from the insect-host over a period of many months, and the possibility of other arthropod and vertebrate hosts acquiring the infection will be described in a fuller paper.

I am indebted to Dr. C. P. Gnanamuthu, M.A., D.Sc., F.Z.S., Director, University Zoological Laboratory, Madras, for valuable guidance, and to the Madras University for the award of a studentship.

Univ. Zool. Lab., (MRS.) E. SITA.
Chepauk, Madras,
April 28, 1949.

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A MODIFIED METHOD FOR THE ESTERIFICATION OF SOME POLYHYDROXY AROMATIC ACIDS

IT is known that esterification of acids can be carried out with alkyl sulphates or alkyl iodides using alkali hydroxide or carbonate in presence of suitable anhydrous solvents. In case of hydroxybenzoic acids, however, it is likely that this method may simultaneously lead to partial etherification also. The Fischer-Speier method using alcohol and concentrated sulphuric or hydrochloric acid also fails in case of some polyhydroxybenzoic acids. Thus, *o*-orsellinic acid has been esterified only by the diazomethane method,[1] and the ethyl ester had not yet been prepared from the acid. *p*-Orsellinic acid has been esterified with diazomethane and also by the action of methyl and ethyl iodides on its silver salt.[2] The usual catalytic method fails in these cases probably because of the ease of decarboxylation of these acids, which may be taking place due to the temperature of the reaction or the presence of the acid.

A new method has now been devised where the esterification is carried out in a dry medium, using a neutral substance like sodium bicarbonate. By this method the methyl esters of both the orsellinic acids were prepared in high yields by refluxing for ten hours in dry acetone with sodium bicarbonate (1·25 mols.) and dimethyl sulphate (1·25 mols.). Excellent yield of the ethyl esters were obtained by similar method using diethyl sulphate (1·25 mols.) or ethyl iodide (3 mols.). It was also observed that even if excess of alkyl iodide was used, the hydroxy groups were not attacked.

α- and β-resorcylic acids also gave good yields by this method ; benzoic acid itself however, gave poor yields.

This new method of esterification is a general one and would be particularly useful for some acids for which the catalytic method cannot be used. It is a good substitute to the diazomethane method having an advantage over it, that it is more simple and that esters other than the methyl can also be prepared. Moreover, it has been found to give good results even with small amount of acids.

A detailed account of the work will be published elsewhere.

Organic Chemistry Labs., P. R. SARAIYA.
Royal Institute of Science, R. C. SHAH.
Bombay,
January 26, 1949.

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SUGARCANE × BAMBOO HYBRIDS

RESEARCH work by Doctors Avdulov and Prat as also by Dr. C. A. Taylor of the Cornell University, Ithaca, New York, would appear to indicate a close relationship between the Bamboo and the Panicoid grasses to which the sugarcane belongs. When the sugarcane bamboo hybrids were first effected by me at Coimbatore in 1936 there were certain Botanists who doubted the possibility. Subsequent work on the Chromosome numbers and the morphological and the histological characters of the F.1 Hybrids at Coimbatore appear to confirm the nature of the hybrids. In the work mentioned above there is further confirmation of the possibility of hybridisation between the above two widely different genera of plants.

T. Nagar, T. S. VENKATARAMAN.
Madras,
May 30, 1949.

REVIEWS

Advances in Catalysis. Volume I. Edited by W. G. Frankenburg, V. I. Komarewski and E. K. Rideal. (Academic Press Inc., New York, 10, N.Y.), 1948. Pp. xiv + 321. 7.50 dollars.

Catalysis is one of those convenient terms that come in handy for describing a reaction whose mechanism has not been fully elucidated. The use of catalysts is none the less of considerable significance and such a large volume of work has been published, that one interested has to go through a maze of literature. The editors' remarks in the preface, "In spite of these amazing successes of catalytic methods and of our increasing knowledge of biocatalysts, only modest progress has been made in the scientific elucidation of the working mechanism and of the basic nature of catalytic action," correctly sums up the situation and one can readily understand the essentially empirical nature of the search for new catalysts. The volume under review is the first of a series which the editors are bringing out with "contributions from scientific and industrial workers that represent complete and detailed surveys of those specific sectors in which these authors are mainly interested and in which they have worked successfully." The present volume is certainly a forerunner of a welcome series fulfilling the objectives of the editors.

The first volume has eight monographs, the majority of them from industrial laboratories, all of them dealing essentially on a subject that attracted considerable attention during the war, namely aviation fuel. The opening contribution of Prof. Taylor gives an account of the work carried out in Princeton on various oxide catalysts in hydrogenation. This is followed by Ipatieff and Schmerling's contribution on Alkylation of Paraffins. It is regrettable that the scope of the article should have been restricted to only scientific literature to the exclusion of industrial applications and Patents. The reviewer is unable to accept the statement in dealing with halide catalysts that "aluminium chloride and boron fluoride, being electron acceptors, are *per se* acids, in the modern meaning of the word". G. N. Lewis' definition expounded by Luder referred to here has not yet received universal acceptance and is not without its drawbacks. In dealing with the mechanism of the reaction the authors are using an anionotropic mechanism which appears to rest essentially on qualitative behaviour without reference to the rate factor. This is clearly an unsatisfactory position requiring further experiments. The article gives a good comprehensive survey of the use of various catalysts in the alkylation reactions.

The use of the Brunauer, Emmett, Teller Equation in the measurement of surface areas of finely divided or porous solids is well illustrated by Emmett's contribution, which includes short critical accounts of other methods, as well as the limitations of gas adsorption methods in general. Griffith's 'Geometrical Factor in Catalysis' strikes new ground indicating a fruitful line of work both on the experimental and on the theoretical side. Dr. Storch's account of the Fischer-Tropsch and related processes fully conforms to the aims of the publication. Besides a useful account of the experimental and theoretical side of the problem of chemisorbed hydrogen, Dr. Eley's monograph is particularly interesting for a brief survey of biological activation of hydrogen and a picture of the transition state as a ring of mobile electrons.

The longest monograph in the volume is the one on alkane isomerisation, the lower members naturally covering the greater part. Both the experimental and mechanistic side find adequate treatment and there are clear indications of the need for further work. The concluding article by Jellinek and Fankuchen gives an account of the exploratory work on the application of X-ray technique in the study of this complex field of heterogeneous catalysis.

Attention has to be drawn to the use of certain terms and contractions not universal but which are presumably normal in American practice: 'alkylate' is used as a noun and 'p.s.i.' presumably stands for pounds per square inch. The reviewer came across a few misprints, one on p. 46 has a missing word. The reference to the paper by Horiuti and Polanyi is wrongly given on pp. 82 and 103 as Horiuchi and Polanyi.

The get-up and production of the book is of the standard that one has come to associate with standard American scientific publications.

The volume should find a place in every library, both academic and industrial, particularly where heterogeneous catalysts are being used or studied. The contents of the second

volume given in the inner flap of the outer wrapper serves as an appetiser for the next volume.

S. V. ANANTAKRISHNAN.

Foundations of Modern Physics. By Thomas B. Brown. (John Wiley & Sons, Inc., New York, Chapman & Hall Ltd., London), 1949. Pp. 390. Price *sh.* 5·00.

The book under review is yet another addition to the large number of books on modern physics which have been published in recent years. Modern physics is an elastic term. Broadly speaking, it includes those discoveries and developments which may have become classic to the physicists, but still may be considered new to scientists generally, as well as to the average well-educated man. The first edition of the "Foundations of Modern Physics" appeared in 1940. It was based on a course of lectures on modern physics given by the author at the George Washington University as the fourth unit of a two-year general course in physics. According to the author, the purpose of the book is to survey the present knowledge in the various fields of modern physics and to acquaint the reader with the methods employed by scientists in their search for more knowledge. The second edition which is being reviewed here has been revised to include the recent advances in physical knowledge. Notable changes are the following: The last three chapters on nuclear physics and cosmic rays have been rewritten and expanded into four chapters. The material on kinetic theory and electronics has been revised, and Chapter V on "Electrical Oscillations and Electromagnetic Waves" has been expanded to include micro waves and radar. An "Introduction" and an "Epilogue" have been added to explain the objective and the philosophy of the book.

The book may be divided roughly into four parts: The first part which includes Chapters I to VI. concerns what may be referred to as particles which behave as particles and waves which behave as waves. The particles include electrons, atoms and molecules and here we are concerned with their physical properties, such as mass, volume and electric charge, and with methods for measuring these properties. Waves include the entire electromagnetic spectrum from radio waves to X-rays, and we are concerned with the methods for identifying these radiations, measuring their wavelengths, and studying their properties. The historic proofs for the wave character of light are included as necessary background and support for the same methods when applied to the newer portions of the spectrum. The applications related to this section include a large part of electronics, radio, and X-rays.

Part two, which includes Chapters VII to X, relates generally to the dual wave-particle aspects of matter and energy, or to the particle characteristics of waves and the wave characteristics of particles. Here are encountered the fundamental concepts of the quantum theory, beginning with Einstein's explanation for the photo-electric effect. Here belongs also an elementary consideration of atomic structure, as revealed by the data of spectroscopy. Applications include electron lenses and the electron microscope.

Part three, Chapters XI to XIV, is concerned chiefly with the kinetic theories for atoms and molecules in solids, liquids, and gases, electrons within metals, and photons in black-body radiation. It gives brief consideration also to molecular forces and crystal structure.

The fourth and concluding section surveys nuclear physics and the physics of elementary particles, including the important topic of nuclear or "atomic" energy. It begins with Chapter XV, on radioactivity, and runs through Chapter XIX on cosmic rays.

A list of problems and references for advanced reading is given at the end of each chapter. The problems have been so chosen as to supplement the text by bringing out additional points of interest. Six appendices are also included dealing respectively with units, universal physical constants, periodic table of elements, period of oscillation of an oscillating electric circuit, relativity and theory for radioactive decay. The book is adequately illustrated with diagrams and photographs.

The author has attempted to cover the entire subject of modern physics in this handy little volume. The treatment is simple and to the point. Emphasis throughout is laid upon the experimental aspects of the subject and upon the evidence which these experiments give in support of the new theories. The book can therefore be easily followed by students of physics who are not familiar with advanced mathematics. The reviewer feels that this book can be recommended for use by the physics honours students of Indian Universities.

R. S. K.

Photography in Crime Detection. By A. J. Radley, M.Sc., F.R.I.C. (Published by Chapman & Hall, London), 1948. Pp. 186. Prcie 21 *sh.*

Crime plays, and has always played an important role in the life of mankind since immemorial time. In the current century, it is said, crime has become a refined scientific pursuit. Those who fight against crime are therefore facing the need for utilising all the advances of modern science for detection and prevention of crime.

In this book "Photography in Crime Detection" the author has managed to pack, within 186 pages, a staggering amount of information on the various uses of modern photographic processes in detection, analysis and proof of crimes. While keeping within limits of popular appeal, the author has made the chapters intensely practical, and valuable alike to the working detective or legal adviser, as to the general reader who finds interest and diversion in greedily imbibing detective fiction.

After a theoretical introduction concerning the role of photography in crime detection, the author goes on to discuss cases involving mechanical vehicles, identification of persons, criminal cases such as murder, house-breaking, sexual offences, counterfeiting coins, gems and precious stones and betting offences. The examination of documents which are disputed on the ground of forgery and the photographing of such documents by normal and oblique lighting for purposes of comparing handwriting, identification of inks, detecting alterations, erasures or additions, etc., are dealt with in detail in a long chapter covering nearly 30 pages. The use of ultra-violet light and fluorescence analysis of documents, photographing documents, fingerprints, etc. by fluorescent light, ultra-violet light and infrared light are covered in a very practical manner under separate chapter headings. The place of photomicrography and X-ray photography in crime detection is rightly emphasised and exhaustive practical information given under relevant chapter heads.

On the whole the book is an admirable condensation of very useful and important information on all aspects of the subject, and at the end of each chapter there is a bibliography which helps to the reader to refer to other literature on the subject for additional information.

No less than 104 reproductions of photographs actually used in various criminal cases illustrate the book throughout, thus clarifying the textual material by visual illustration.

The author deserves special commendation in keeping one main principle in view, which he states in his preface: "Every effort has been made to present the material in the simplest manner possible and the examples have been selected for their value in *illustrating the various techniques* rather than for their sensational value."

Professional men in the police departments and lawyers and judges will find much of real value in this book, while photographers, both professional and amateur, will realise that their fellow-photographers who do specialised work in police laboratories or in forensic science laboratories rank among the best exponents of photographic technique and ingenuity.

S. LAKSHMINARASU.

Biochemical Evolution. By Marcel Florkin Edited, translated and augmented by Sergius Morgulis. (Publishers: Academic Press, New York), 1949. Pp. 157. Price $ 4·00.

The purpose of the book is to focus the attention of interested workers on the probability of finding a biochemical basis for the evolutionary changes in the animal kingdom. Morphological considerations have dominated till recently the studies dealing with evolution and zoological classification. It was time that the relation between form and the biochemical processes was taken into consideration in greater detail. Not that it has not been done. But the present volume succeeds in doing it within the limited space of 143 pages of a well-documented book. The information on biochemical systems, adaptations and characteristics which has been laboriously collected in various laboratories and in the collection of which the author himself has been well to the forefront has been ably marshalled and presented in this small volume in support of the main thesis. The material contained therein does provide considerable evidence in support of the thesis propounded by the author. At the same time it also shows up several gaps which exist in our knowledge. The author's contention that form is the resultant of an interaction of biochemical systems with molecular and submicroscopic architectural patterns is one which appeals to the biochemist, but it will be agreed that considerably large body of information will have to be collected before this concept is widely accepted. Evidence is not wanting to suggest that systems like osmoregulation, respiration, digestion, etc., as well as metabolic patterns have closely accompanied the morpho-

logical evolution in the animal kingdom. Only further work will show whether they have determined the form or have been themselves determined by the latter. There is no doubt that whichever way it turns out to be, the biochemical concept of evolution is certainly very attractive and is bound to stimulate further intensive effort.

V. N. PATWARDHAN.

Birds in Britain. By Frances Pitt. With 17 coloured plates and numerous photographs and figures in the text. Pp. viii + 576. Size 9" × 6". London, 1948, Macmillan & Co. Ltd.

It is a significant tribute to the enthusiastic and everwidening circle of bird-lovers in Britain that every passing year is enabled to add its quota to the already imposing array of British bird books.

Frances Pitt, the present author, needs no introduction. Her frequent contributions to *Country Life* and similar periodicals have delighted readers for upwards of 3 decades and so have her several books on natural history subjects, of which one that this reviewer can recall with especial satisfaction is "Wild Creatures of Garden and Hedgerow".

Referring to the number and variety of books on British birds already in the field, Miss Pitt in her Preface says "....nevertheless there seemed space for yet another, a survey of the bird life, wild, feral and domestic in Britain, which would tell concisely of their status, appearance and habits with the special view of assisting the recruit to the study of ornithology". How well the book fulfils its purpose will be evident from its contents and treatment.

The first 90 pages (Part I) are devoted to a general review of the Class Birds. It is divided into 5 succinctly written sections: The Bird's Place in Nature, Structure of a Bird, Distribution of Birds, Migration of Birds, and Bird Behaviour. To indicate the comprehensive nature of the topics covered by the sections, some of the sub-titles may be quoted: Classification of Birds, Birds in Britain, Birds and Plants, Domestic Birds, Bird Sanctuaries, Feathers, Moults, Ancestry, Sexual Selection, Protective Colouration, Adaptation to Environment, Limitation of Dispersal, Adaptation to Special Conditions, Rise and Fall of Species, Formation of Geographical Races, Causes of Migration, Migration and Natural Selection, Bird-ringing Schemes, Instinctive Nest-building, Parental Care, Courtship Rites, Song, Social Gatherings, Territory, etc.

A notable omission is The Bird's Egg, which seems curious considering what an important phase egg-collecting constitutes in the life of the average British schoolboy, and what a number of distinguished ornithological careers owe their beginnings to this largely nefarious activity.

The accounts are interspersed with legends, popular superstitions, folk-lore, personal anecdotes and well selected verses and quotations about birds, which enhance the interest and readability.

Side accounts, for example the history of the canary, now such a favourite cage bird in Europe and elsewhere, are revealing. The original canary is a native of the Canary Islands, Azores and Madeira. It is a plain looking greenish-grey little bird closely allied to the finch known as Serin (*Serinus canarius*), with nothing particularly remarkable about its song. The yellow canary, as seen in cages, is a colour-mutation stabilized by artificial selection and breeding—more or less on a par with the blue variety of the Australian Grass-parakeet or Budgerigar so fashionable with fanciers at the present day. The sustained and spirited rolling song of the tame canary is of course largely the result of training.

The Turkey, found wild only in the New World, was apparently first domesticated in Europe in the 16th century. Unfortunately we are not told how, and since when, it has come to be so intimately associated with Xmas particularly in Britain and her colonies.

Many of the other topics dealt with are of far more than a circumscribed ornithological interest. They treat of aspects of birds and their study which even the browsing general reader will enjoy and profit by. In regard to migratory starlings carrying the virus of foot and mouth disease of cattle from the Continent to England, the author writes "But there is no direct evidence of any kind to confirm the suspicion, only circumstantial evidence being available, and the accusation may rest on nothing more than coincidence". But the fact that outbreaks generally start near the east and south-east coasts of England where continental starlings arrive, and do not occur in Scotland where migratory starlings do not go, seems to us something more than mere coincidence.

Some naturalists apparently still believe that the "bleating" of the Snipe during its aerial nuptial display is vocally produced.

That this, in fact, is a purely mechanical sound produced by breeze rushing through the

widely spread outermost tail-feathers was proved once again by the author's experience of the snipe tail-feathers which she had struck in her hat band. The breeze blowing through the feathers caused them to vibrate and emit the characteristic "bleating". Taking off the hat ended the music; replacing it on her head started it again.

This reminds us of the similar controversy of a more or less perennial nature in regard to the "drumming" of woodpeckers. One school maintains that the sound is purely vocal, the other purely mechanical. The fact that drumming on a steel telegraph post produced a metallic sound, as recorded by one observer, would seem to settle the point but it has evidently not done so!

The enigma, experienced by all aviculturists, of certain species of wild birds which become perfectly tame and reconciled to captivity and yet consistently refuse to breed under these conditions, though other closely allied species do so freely, is difficult to explain and calls for closer investigation.

Part II of the book describes the families and species of birds, common, rare, and those introduced into Britain as livestock or as cage birds. This part follows the same systematic order and arrangement as Witherby's standard 5-volume "Practical Handbook of British Birds", beginning with the Crows and ending with the Game Birds.

The book is pleasing to handle and well printed both as regards text and the illustrations (chiefly photographs), which are numerous and well chosen. The coloured frontispiece of Goldfinches by Winifred Austin, and the coloured plates by the well-known bird artist Rowland Green, form an attractive feature. They depict in all about 92 species of the commoner birds of Britain. Bird-lovers in every country will welcome this latest addition to Messrs. Macmillan's "In Britain" series, of which 3 other uniform volumes—"Flowers in Britain", "Trees in Britain" and "Dogs in Britain" have so far been published.

S. A.

Handloom Weaving Industry in India. By M. P. Gandhi. (Published by M|s. Gandhi & Co., Jan Mansion, Sir Pherozeshah Mehta Road, Bombay; Post Box No. 80), 1948. Price Re. 1-8, with a Foreword by H. E. Sri Mangaldas Pakvasa.

This is the third monograph on the most important small-scale industry in the country by an author well known for his various publications on the economic problems of our Textile Industry. Like its immediate predecessor (reviewed in *Current Science*, Vol. 16, No. 11) it contains a wealth of useful information on the past struggles, existing difficulties and future possibilities of this ancient industry. Besides giving copious extracts from the reports of the meetings of the All-India Handloom Board and its various Committees and the report of the Fact Finding Committee who have made a first hand study of the problem, the author ventures useful suggestions not only for the preservation but also for the development of this important industry whose survival would make all the difference between existence or otherwise to nearly ten million people depending directly and indirectly on it.

In a short Preface the author summarises the existing conditions *vis a vis* Government efforts and indicates the possible lines of development like statutory percentage allocation of mill yarn and standardisation of its strength, formation of co-operative societies for supply of raw material and sale of finished cloth, transport facilities, novel designs, research on processes and material, use of mixture yarns, etc., which are quite practical. An all-India organisation embracing various aspects of the Industry is envisaged to enable active steps being taken on these lines. Standardisation of handloom goods both in quality and price is proposed though perhaps the survival value of the handloom lies in the long run in its richness of variety. The importance of research and marketing facilities is rightly stressed. Lack of finish, for instance, which robs the handloom goods of sales appeal, could be remedied by research and centralised finishing organisation.

Giving a historical review, the impact of the growth of the Mill Industry as well as the competition from the small-scale Power Loom Industry are briefly discussed. The vital importance of this long established industry which still produces 1,300 million yards or nearly 25 per cent. of the country's cloth production valued at 100 crores of rupees and employs nearly 2½ million hands against a three-quarter million employed by the Mill Industry, to the economic structure of the country is vividly portrayed (the effect of the division of the country on these figures requires scrutiny).

The author's own remarks are so freely interspersed with the extracts from other reports that it is often difficult to distinguish one from the other. Division into chapters and an index would be more useful. While there are few misprints 'shapes' and 'shares' (page 38) should

read 'shades'. The author would do well to revise the table on pages 64 and 65 which show certain discrepancies in figures, and incorrect totals. The obsolete 'Art Silk' should be replaced by 'Rayon'.

Mr. Gandhi deserves the congratulations of everyone interested in the welfare of the millions of our countrymen who depend almost entirely on this Industry for their livelihood, for presenting a clear and stimulating picture of the problems of the handloom industry, as well as its national importance and pleading for a vigorous and concerted action on the part of the Government and those engaged in the Industry. SRINAGABHUSHANA.

Report of the Planning Committee for Geophysics. (Printed by the Government of India Press, Calcutta), 1948. Pp. 1-103.

The Government of India had constituted a Planning Committee in January 1946 "to consider and report on the question of organizing and developing in India institutions dealing with the study of Geophysics". This Committee held seven formal meetings in all, but considerable work is also said to have been done through informal discussions between the members. The Committee took stock of the contributions to Geophysics — both in the scientific and economic aspects — which have been made in this country. The scope for further development in each of the branches of the subject was considered, and a number of recommendations have been drawn up giving the lines on which the work in future should be carried out. These recommendations have been submitted to Government of India for consideration.

The Report under review presents a comprehensive account of the deliberations of this Planning Committee, in five chapters. A summary of their main recommendations is given in Chapter Six. There are also elaborate Appendices recording twenty-four important Notes and Papers submitted to the Committee. Most of these papers give a succinct exposition of the data and knowledge which has been so far obtained in the country by measurements of Gravity, Terrestrial Magnetism, Atmospheric Electricity, Hydrology, Oceanography and also of the progress made in Geophysical prospecting.

In regard to the measurements of Gravity, the Survey of India have formulated a scheme to cover the whole country with a network of gravity stations at intervals of 10 miles. The new type of Frost Gravimeter which is capable of making rapid measurements of gravity with great accuracy, has been obtained by the Survey of India. The Planning Committee have recommended that high priority should be given specially to cover the areas constituting: (*i*) the south and south-eastern margin of the Deccan traps, (*ii*) the eastern margin of the rocky terrain comprising the coalfields in Bengal, and (*iii*) the northern border of the Vindhyan plateau and south eastern Rajaputana. It is now learnt that the Survey of India have, during the last year, already started the gravimetric survey in the Raniganj area. The results of this survey will be watched with keen interest.

In respect of Seismology, the Committee have recommended that seismograph stations with modern instruments should be set up in the earthquake zones of India. More especially, it has been urged that steps should be taken up immediately for the study of earth movements at sites of big dams like the Sukkur Barrage in Sind. (It must be remembered that the constitution and deliberations of the Committee took place before the political partition of India) and the proposed Dam sites of the Kosi, Damodar and other projects. The memorandum on a plan for a seismological station network in India with reference to the Kosi River Project, by the U.S. Coast and Geodetic Survey, given in Appedix 9, furnishes some brief descriptions of the different instruments outlining their basic operating characteristics, and cost. The policy to be adopted in planning stations and their distribution, with a reference to the engineering problem, have also been given. The Director-General of Observatories in India has obtained sanction for the purchase of some of the instruments, and further work on the lines suggested by the Committee is very likely under progress now.

The study of secular variations in Terrestrial Magnetism in India for some years has suffered owing to the absence of observatories at suitable centres. The Committee have recommended that the number of magnetic observatories should be increased to five as in the past. They have agreed to the shifting of the Alibag Observatory to another location which s not likely to be affected by electrical installations and other encroachments. Recommendation has also been made that the Survey of India should take magnetic observations on a fundamental grid all over the country with stations at 10 miles interval.

With regard to Hydrology, a number of recommendations have been made, chiefly relat-

ing to the Rainfall registration and returns, increasing the number of stations recording temperature, setting up stations for observations of snow-fall and snow surveys in the Himalayan catchment, collection of information on ground-water supplies, systematic river-gauging and standardisation of data, and also the determination of water balance in selected catchment areas.

Development of Oceanography in India has also been considered by the Committee and a note on this subject by Dr. K. R. Ramanathan furnishes a brief resume of the researches so far carried out in the Indian Waters. The importance of studies of oceanography—both as a fundamental science, and for its practical usefulness in the development of Fisheries, Navigation and Meteorology—have been pointed out. The Committee have recommended that the plan for development of Oceanography should be worked out by another Committee—an enlarged one including themselves, with representatives of the Royal Indian Navy, the Zoological Survey of India and the Departments of Fisheries in Provincial Governments.

Geophysical prospecting—*i.e.*, the application of Geophysics to the location of hidden mineral deposits, structures and other economic and engineering problems—has also been considered by the Planning Committee. Their resolution is to the effect that it "welcomes the formation of the Geophysical Section of the Geological Survey of India and recommends that all possible assistance should be given to the Geological Survey by Government and other Scientific departments for extending their geophysical activities." The programme of the Geological Survey of India is stated to concentrate for the moment on numerous immediate problems connected with dam foundations, river sand supplies, metalliferous and coal deposits, etc. As a long-range scheme they will keep in view the program of the study of the bottom of the Indo-Gangetic trough. The building up of a Laboratory and research organisation at Headquarters, has also been taken up.

In respect of Geophysical Prospecting, the Planning Committee have laid some emphasis on the opportunities that may await the geophysicist in discovering mineral deposits possibly hidden under thick overburden in 500,000 square miles of alluvial tract, and in about 200,000 square miles of area covered by the Deccan Trap. If one were to add to this, the coastal strips covered by the sea, we could count on quite an immense area for geophysical exploration in India. But these are not problems easy of solution, and in the present context of the country, the examination and development of some of our known mineral fields where the outcrops of ores and other useful minerals may lie concealed under a veneer of soil and debris, are more important. The case for geophysical exploration for oil stands on a different footing, and opinion can be sharply divided on this question whether Government could effectively undertake such ventures and spend many lakhs of rupees a year on a speculative basis, or whether the matter should be left aside for private enterprise. There is no indication in the Report that the Planning Committee have examined this question. The terms of reference for the Committee were very wide and general, and also as Dr. Dessau has remarked elsewhere, "amongst members of the said Committee people with practical experience in geophysical exploration and representatives of the oil and mining industries where such methods are chiefly employed were but meagrely represented."* Naturally, under these circumstances, some of the important questions relating to geophysical exploration in India have failed to receive consideration.

The Committee have appreciated the need for establishing facilities for imparting instructions and practical training in the geophysical methods. They have considered a detailed plan prepared by Prof. M. N. Saha for starting a Central Geophysical Institute in India. This plan presents very carefully worked out proposals outlining the courses of study, laboratory and other equipment, building, personnel, etc., required for the Institute. The Committee however have not accorded a priority to this scheme but recommended that Universities should offer facilities for teaching geophysics for the M.Sc. courses, and that the Central Government should give financial aid to such Universities as are prepared to do so. At present even combination of Physics or Mathematics with Geology is not permitted in most of the Universities in India. It is doubtful if any Universities will respond in a liberal measure to the Committee's recommendation. The Indian School of Mines at Dhanabad could easily start a geophysical section on the model of the Colorado School of Mines. In some

* G. Dessau: "Past & Future of Exploration Geophysics in India", *Trans. Mining, Geological & Metallurgical Institute of India*, September 1947, **43**, p. 43.

respects, this may have more advantages than starting an independent Geophysical Institute.

Finally, the Committee have recommended the formation of a National Committee of Geodesy and Geophysics, and also a Central Board of Geophysics. The National Committee is proposed to take steps for its affiliation with the International Union of Geodesy and Geophysics, while the Central Board is to function as a Standing Committee for co-ordination of the geophysical work carried on by the various scientific departments and Universities.

On the whole, the Report of the Planning Committee constitutes a valuable scientific document, while the recommendations if given effect to, would lead towards a progressive and integrated knowledge of Geophysics in India.

M. B. R. RAO.

SCIENCE NOTES AND NEWS

Lady Tata Memorial Trust

The Trustees of the Lady Tata Memorial Trust announce on the 18th June 1949, the death anniversary of Lady Meherbai Dorabji Tata, awards of scholarships and grants for the year 1949-50.

The international awards of varying amounts (totalling £3000) for research in diseases of the blood with special reference to Leucæmias are made to Doctors Edith Paterson (England), M. C. Bessis (France), J. Bichel (Denmark), Pierre Cazal (France), J. Clemmesen (Denmark) C. F. M. Plum (Denmark), E. Kelemen (Hungary), Edoardo Storti (Italy), Charles Oberling (France), Jagdish Chandra Mehta (India), Pascou Atanasiu (France) and Gunther Schallock (Germany).

Indian Scholarships of Rs. 250 per month each for one year for scientific investigations having a bearing on the alleviation of human suffering from disease are awarded to Messrs. Gangagobinda Bhattacharya (Calcutta), Bimal Kumar Sur (Mysore), K. Ramamurti (Bangalore), Gauranga Roy (Calcutta), D. V. Siva Sankar (Madras) and P. R. Srinivasan (Coonoor).

Director of Geological Survey

Dr. M. S. Krishnan, Director of the India Bureau of Mines, New Delhi, it is understood, has been appointed to act as Director of Geological Survey, in the place of Dr. W. D. West who is proceeding on leave. Dr. Krishnan is the first Indian to be appointed to the post.

Award of Research Degree

The Syndicate of the Andhra University have resolved that Mr. C. Ramasastry, M.Sc., be declared qualified for the degree of Doctor of Science (D.Sc.) on the recommendation of the Board of Examiners consisting of: Dr. R. W. B. Pearse, Dr. R. F. Barrow, Prof. W. Jevens appointed to adjudicate on the thesis entitled "Band Spectra of the Diatomic Halides of Zinc, Cadmium and Mercury and Spectrum of Triatomic Molecules CS_2.

World Medical Conference

The general conference of the World Medical Association is being held in London this summer.

Sixteen nations are preparing the agenda at preliminary committee meetings. These are now proceeding in Madrid.

World Tuberculosis Conference in London

Representatives from all over the world—from 33 different countries, including all those of the Commonwealth—are to attend the second Commonwealth and Empire Health and Tuberculosis Conference, to be held in London from July 5 to 8.

The Conference, which is being arranged by Britain's National Association for the Prevention of Tuberculosis, wil give special attention to Commonwealth questions but the opening session will be devoted to tuberculosis as a world problem because it is against this background that all other problems must be considered.

India will be represented at the Conference by a delegation of five. It will consist of Dr. P. V. Benjamin, a member of the Tuberculosis Association of India, Major Khushdeva Singh, Dr. Ram Chandra Adhikari, Dr. P. K. Ghosh and Captain S. D. Sharma. Dr. Benjamin, who read a most interesting paper at the last Conference, will be one of the speakers at this year's Conference.

One of the most interesting features of the Conference will be an exhibition illustrating

the most modern methods in the diagnosis, treatment and prevention of the disease, both scientific and psychological.

On the scientific side there will be exhibits illustrating the manufacture and use of the new drugs Streptomycin and para-Amino-Salicylic Acid and an X-ray demonstration unit with a darkroom in which films will be shown. On the psychological side the Art Therapy exhibit will be especially interesting as this scheme, started by the N.A.P.T. three years ago, has now been adopted with great success in over 100 sanatoria.

The Royal College of Physicians, the Matrons and Medico-Social Sections of the N.A.P.T., and the journal *The Practitioner* are planning to give receptions for Conference members. There will be a large choice of specially arranged visits of medical interest to such institutions as Brompton Hospital for Diseases of the Chest, the King Edward VII Sanatorium at Midhurst in Sussex, Papworth Village Settlement at Cambridge, and Harefield County Hospital, Middlesex.

Study Grants for Indian Scholars

Under the scheme for the promotion of interchange between British Universities and those in Commonwealth countries, the British Council has awarded travel grants covering return fares to Mr. O. P. Bhatnagar, Lecturer in History at Allahabad University, and to Mr. B. Bhattacharya of Benares Hindu University.

Mr. Bhatnagar will visit London University and Mr. Bhattacharya will study spectroscopy at Cambridge.

200th Anniversary of Dr. Edward Jenner

To commemorate the 200th anniversary of the birth of Dr. Edward Jenner, the British physician who introduced to the world the technique of vaccination, an exhibition has been arranged in London.

It was in 1798 that Dr. Jenner first placed before the world the results of his researches into the possibilities of vaccination. This new technique soon spread to all parts of the civilised world and by 1800 had become recognised medical practice. He was the first person to introduce the idea, and the first to have the courage to test his theories in practice.

It was not till about 80 years later that Pasteur extended Jenner's discovery by using vaccination against cholera and anthrax. It was he who proposed a meeting of the Medical Congress in London, that vaccination be officially adopted as the term for this method of conferring immunity from infectious diseases. He suggested this as a "homage to the merit and immense services rendered to medicine by one of England's greatest men, Dr. Jenner".

Los Angeles Arboretum

Dr. Frans Verdoorn, who has been Director of the Los Angeles State and County Arboretum at Arcadia near Pasadena, California, since last autumn, will return to his editorial, historical, and international relations work at Waltham, Massachusetts on April 15, 1949.

It is with deep regret that the Trustees of the California Arboretum Foundation, Inc. accept his resignation on completion of the initial organizational phase in the development of the Arboretum. Its office, library and the Southern California Horticultural Centre have been established, and preliminary landscaping plans (by Architect Bent) have been completed, and a Biological Survey of the Arboretum area is well under way.

Dr. Verdoorn will continue to serve the Arboretum as a Councillor.

Pending the appointment of a new Director, Wm. Hertrich, Curator Emeritus of the Huntington Garden, and a member of the Arboretum Board of Trustees, will supervise horticultural activities, Mr. Howard Miller, of the Los Angeles Chamber of Commerce, the general office, and Mrs. Richard Dakin the historical reconstruction work.

George Spalding, Propagator at the Arboretum, has been appointed Acting Superintendent.

Indian Standards Institution (ISI)

The International Organisation for Standardization (ISO) is holding a number of Conferences in Paris from the 25th of June to 11th of July next, at which India will be represented by Dr. Lal C. Verman, Director of the Indian Standards Institution (ISI). Apart from the ISO Council, of which India is an elected member, the General Assembly of the ISO, on which 27 leading nations of the world are respresented, will meet for the second time since its inauguration in 1946 in London. Ten of the 69 Technical Committees of the ISO are expected to hold working sessions in which concrete proposals for International standardization of sevaral subjects will be discussed and programmes for future work in these fields will

be laid down. Revision of ISO statutes will also be considered by a Special Committee of the ISO Council, of which Dr. Verman is a member.

Dr. Verman, who will be leaving for Paris on the 24th of June, has been selected by the ISI to represent India in all these conferences of the ISO. It is anticipated that he will take this opportunity to hold informal consultations with delegates from other countries concerning international standardization of Shellac and Mica in which India is most interested from the export point of view, and for which India has been entrusted with the secretariats of the ISO Committees. The ISI had already circulated draft proposals for standardization in these two fields to all the ISO Members interested in the subject and Dr. Verman will endeavour to arrange that it should be made possible for the ISO Committees on Shellac and Mica to meet in India during the coming winter.

Brazil's Jute Industry

A campaign for an all-out Government support to Brazil's jute industry, which is reported to have made a "miraculous recovery", has been launched by a united front of cultivators, manufacturers and exporters, reports the May issue of the *Jute Bulletin* recently released by the Indian Central Jute Committee. Trade circles in Rio de Janero believe that Brazil which is now producing sufficient bags will eventually be able to produce surplus jute for export. There was a storm of protests from sacking manufacturers and exporters alike when a bill seeking to allow duty-free importations of used jute bags was recently introduced in Congress.

Recent production figures from Amazonas and Para, whose combined output jumped from less than one million kilos in 1941 to more than 7 million kilos in 1947, provide reasonable basis for the prediction made by the Rio Weaving Syndicate that complete self-sufficiency would be achieved by Brazil in 1949. It is estimated that the 1949 crop will be three times the 1947 figure. Conversely, imports of Indian jute dropped from over 25 million kilos in 1938 to only 10 million in 1947.

At present imported jute constitutes 40 per cent. of the raw material consumed by Brazil's 33 sacking factories. The other 60 per cent. is indigenous and includes Caroa and several other native fibres grown in Northern States. Last year 32 million jute bags crossed Brazil's borders carrying exports of various agricultural roduce.

Experimental Cell Research

A new journal is about to be launched under the auspices of the International Society for Cell Biology.

Experimental Cell Research will publish papers dealing with experimental analysis of the activity, structure and organization of the cell and its subunits, including work on virus. Technical or theoretical papers aiming at the further development of methods in the field of experimental cytology will also be included. Papers may be submitted in English, French, or German.

Experimental Cell Research will be edited by Törbjorn Caspersson, Stockholm; Honor Fell, Camdribge; John Runnström, Stockholm; Francis O. Schmitt, Cambridge, Massachusetts; Paul Weiss, Chicago, Illinois; Ralph W. C. Wyckoff, Bethesda, Maryland. J. F. Danielli, London, will act as editor of communications from the Society for Cell Biology.

Authors residing in the Western hemisphere should send their papers to U. S. editors; those residing in the British Isles should mail them to Dr. Honor Fell, Strangeways Laboratories, Cambridge; papers originating in other countries should be forwarded to the Scandinavian editors.

One volume, consisting of four issues, will be published annually.

The new journal will be released under the imprint of Academic Press, Inc., New York.

ERRATA

Vol. XVIII, No. 5, May 1949, pages 180-81

Note on *Cerebella* on Sugarcane :

In the heading
for "*Cerebella* on Sugarcane" *read* "*Cerebella* on Sugarcane ergot".

p. 181, line 3, *for* "inhabit sceloritial development" *read* "inhibit scleortial development".

p. 181, para 2, line 7, *for* "suppressing the scelorotial stage" *read* "suppressing the sclerotial stage".

Editor: M. Sreenivasaya, B.A., F.I.I.Sc., F.A.Sc.
839-49 Printed at The Bangalore Press, Bangalore City, by G. Srinivasa Rao, Superintendent and Published by Dr. M. A. Govinda Rau, M.A., Ph.D., for the Current Science Association, Bangalore.